

# Aviation Week

*and Space Technology*

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A McGraw-Hill Publication

July 3, 1961

**Surveyor Probes  
Will Seek Clues  
To Solar Origins**

RAF Lightning  
Aerobatic Team





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"One thousand per cent the first full year of operation and 2,000% by the end of the second year." That's how G. M. Belias, Los Angeles Airways president, summarized the projected growth of this pioneer helicopter airline, readying now for delivery of its first Sikorsky S-61L's late this year. Operating a total of five S-61L's over expanded routes, LAA expects the 28-passenger turbopropellers to reduce seat-mile costs by one-half over its present piston-powered S-55's. The airline will also take full advantage of the Sikorsky turbopropeller's rotary cargo areas to further expand its cargo-mail-express business, now handling over eight million pounds yearly. The Sikorsky S-61L, first helicopter ever designed from the start for use as an airliner, provides comfortable, quiet airliner-type cabins... twin-turbine reliability... all-weather flight capability. For complete cost and operating facts, call or write Sikorsky Aircraft.



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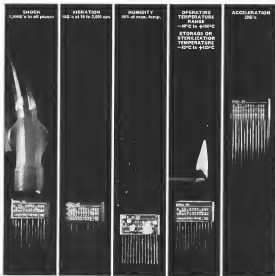
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## New concepts in ducting systems reflect demands for higher performance

As temperatures, pressures and complexity of ducting systems for ultra-sonic aircraft and missiles increase, weight limitations become proportionately more stringent. To solve these problems, Solar Aircraft Company has been developing new design concepts and advanced fabrication techniques. All of these concepts and techniques are currently being used in the development and manufacture of pneumatic systems for America's most advanced aircraft.

### Weight Presents Problem

Without exception, design requirements are extremely critical in the areas of weight, temperature and pressure. An idea of the scope of



the problems encountered can be visualized in one current system. If it were built entirely of the lightest gauge aluminum it is currently practical to fabricate and if conventional insulation were used, the system

would be more than 100 pounds overweight.

Weight isn't the only problem. Temperatures in this system go up to 1500°F, pressures reach 450 psi. Conventional materials and methods are made obsolete by ultra-sonic aircraft. Solar research, engineering and manufacturing teams with 15 years experience in the field of aircraft and missile ducting have developed a number of feasible approaches to the problem. One is an air film method of insulation to contain the heat of the air within the ducting system by means of an air gap between an inner and outer wall. As part of this insulation concept, Solar research has developed a special high emissivity coating. Called Solar black silicone, the coating has an emissivity rating of .99 on a scale of one

—higher than any similar material being tested.

### Materials Offer Solution

To solve the weight problem, Solar has been developing systems involving extremely thin gauge super-alloys and systems made primarily of non-ferrous materials. The company's extensive experience in the development and production of high pressure, long life-cycle bellows and graballs has also contributed



The ultra-sonic aircraft ducting program is only one of several now underway at Solar. They include development of the boundary layer control system for the Navy's new F4H fighter, engine ducting system for an aircraft nuclear propulsion and ducting system and components for the AJ3 attack bomber, F-102 fighter and C-130 cargo transport. In these programs Solar was usually given envelope size and interface routing for the system, together with design parameters. Frequently, however, a system is designed by the aircraft contractor and Solar assists in the development.

For information about Solar's capability in the design, development and manufacture of ducting systems and components, write to Dept. J 125, Solar Aircraft Company, 2200 Pacific Highway, Sea Diego 12, California.

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**Focus Coils and Solenoids:** Pail or wire wound in any size — from low-noise TWT's to super-power klystrons. Epoxy impregnated by vacuum or pressure. One terminal board. One coolant input/output manifold. Leak-resistant cooling systems. Integral lead shielding.

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Other Litton tube accessories are radiation shields, differential thermopiles, and cathode sockets and contact fingers.

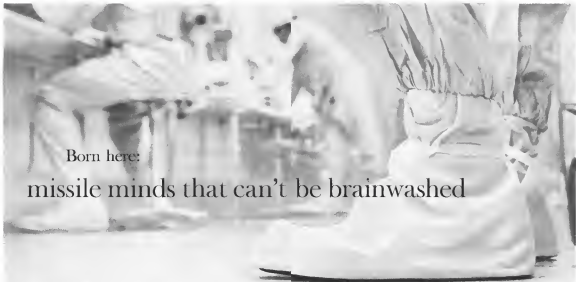
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Accelerometers built in this room are so sensitive they can measure movements we cannot see. In missile inertial guidance systems they can sense acceleration of .003 of an inch per second per second.

But a tiny speck of dust between their micro-finished surfaces could make them useless for the "mind" of a missile.

This type of accelerometer combined with gyroscopes and advanced electronics results in an inertial guidance system

which is completely self-controlled—it cannot be "brainwashed." It needs no commands from the ground. It is invulnerable to "jamming" which might throw it off course.

Hughes is now applying its complete system experience to all pertinent areas of creating inertial guidance systems: inertial components, computers, guidance, support equipment, advanced systems studies.

**Hughes inertial guidance systems** "mimic" the latest developments in both electronics and mechanics. With this effort Hughes adds another facet to its broad scientific and production capabilities. The experience now is useful to you. We can have the answer to your problem. The result could be profitable for both of us.



Close-up view of an accelerometer being assembled in the Hughes dual-flow clean room.

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## New Transportable Radar Directs Precision Air Support

Front-line ground forces can now obtain all-weather, close air support, —when and where needed—with the new lightweight AN/TPQ-10. This is the first helicopter-transportable, high-accuracy control radar for precision air support. Developed for the U. S. Marine Corps by General Electric's Heavy Military Electronics Department, the versatile new system can also provide aircraft control for emergency supply airdrops, paratroop placements and aerial trapping.

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## EDITORIAL

### Crisis on the North Atlantic

The current financial crisis confronting the North Atlantic carrier provides another sharp focus for the unsolved problems of the jet age which have the air transport business in serious trouble. The scheduled mail decline in total passenger traffic leaving the Atlantic would not be small amount for the carriers of the problem now facing the North Atlantic carriers. For it is with the enormous, unabsorbed increase in seat capacity afforded in the first year of large-scale jet fleet operations on this route that is the core of the problem.

The economic measures of the last year would naturally account for some decrease in vacation travel, the backbone of the North Atlantic business. But even with a major recovery in the general economy, which is a certain, not yet in sight, the basic elements of the airline's problems in the jet age will remain.

Certain technical improvements will certainly lower down the operating costs of jet transports, and a thorough overhaul of airline administrative structure is long overdue to cut costs still further. But the basic element, without which any other solution will fall far short of the goal of a viable, profitable operation, is the answer to the problem of filling the large quantities of empty seats now being flown in jet transports, not only across the North Atlantic but also on the main domestic routes.

The airline slump cannot end in the future on the eve of the market they have developed in the past. Simple logic would indicate that the real problem facing the airline today is to develop new markets that will fill their expanded jet capacity to load factors that will offset rising operating costs and provide the necessary margin for continued profits, which are so desperately needed to stabilize the entire airline picture.

The simple logic has been apparent to many airline people from the dawn the first cabin diagnosis of the jet transports were presented. Unfortunately, there has not been sufficiently widespread recognition of this logic to convert the airline's sales philosophy or economic basis. The carriers are still concentrating for a larger scheduled share of the already existing air travel market, and their major efforts are pinned at switching a customer's allegiance from one basic flag to another.

It has been obvious to many airline people that in the jet age the principal problem of enlarging the air travel market and filling the long rows of vacant seats in jet cabins lies in selling the users for a lower price. Now, lower fares are not a panacea for all airline problems, but they are a vital factor in increasing the trip frequency of current long-haul travelers and they have been successful in the past in generating healthy new traffic on the long-haul routes.

It seems to us that the North Atlantic is an ideal place to put this theory to the test if any further testing is needed. Many airline people will agree that it has already been impossible for building both the domestic and international long-haul traffic to its current amazing volume through the steady increase of coach and economy class service.

There are some airlines who have fought valiantly in

the past to cut North Atlantic fares to lower levels that would widen the appeal of the air travel market into new economic groups. There also has been a small, but even of government supported, international carriers who are not only interested in the hard economies of making money on the airline business but simply pass on their losses to their national taxpayers through subsidy requirements.

It is this basic conflict within the framework of the International Air Transport Association that has come previously close to reaching its carefully controlled rate setting procedures under during the past few years. With the new pressure generated by the financially distressed members of the North Atlantic, we predict that the old high fare assembly line will be making its last stand at the next IATA traffic conference in 1962.

But lower fares on the North Atlantic will not entirely solve the current crisis on this once highly profitable route. While airline seat capacity has jumped 50% in the past few years, European hotel capacity has been increasing at an almost phenomenal rate. For American World Airways is now building up hotels in Europe to help solve this problem, and the spare of new hotels in Copenhagen and Rome is the most comfortable solution through which to enter Europe. But London, Paris and Rome are still acute hotel bottlenecks, and the hotel industry is even worse. It will do the airline little good to attract a new mass market of European vacationists with low fares if they cannot also guarantee hotel space ahead.

Another insuperable factor in the European air travel picture is the extremely high fares that still prevail as the outcome—an obsolete hangover from the old cartel and pricing philosophy that no longer makes any sense in the jet age of excessive seat capacities. Hopefully, during our recent swing around Europe we heard something about the airline industry's new economic airfare executives with this obsolete high fare structure. We predict some pressure will eventually be brought to bear to permit the development of a larger air travel market within Europe.

Another consideration that no longer has much place in the jet age is the super de luxe first class service that was perhaps the original airline sales pitch in attracting the businessmen and celebrities who were once the backbone of the airline market. Today, first class service offers so little basic advantage over economy class that the price discrepancy is too much for even affluent passengers to swallow. As the economy class cabins become more crowded the first class passengers have a hard time finding comfort in their isolated elegance.

The current crisis on the North Atlantic should shake the last of the old line, high fare cartels out of airline management and its international regulatory bodies and permit the hard facts of modern air transport economics to take over. If they don't, U. S. taxpayers, for one, are not going to swallow another subsidy bill, and the international airlines will be in a deep trouble.

—Robert Hertz



## BURGOYNE IGNORES RECONNAISSANCE AND INVITES DISASTER

General "Gentleman" John Burgoyne was not one to fret over reconnaissance.

Saratoga, frequently called the turning point of the American Revolution, was the end product of a series of "no reconnaissance" blunders fatal to Burgoyne's mission force. Repeatedly confident he was being outflanked from Canada, the British commander rarely knew where or what was ahead. Sir John's British force, vital element in Burgoyne's campaign, disintegrated when its sizable Indian contingent vanished at news of a huge American counter force. Reconnaissance would have readily shown the Americans mustered more than 1,000 men. Along his march, Burgoyne dispatched his grenadiers to reinforce a Hessian advance unit at Bennington.... as usual, without adequate reconnaissance. The grenadiers did not discover until after they were decimated by a Colonial force that the Hessians had already been wiped out. Finally,

Burgoyne's confused and weakened men, alone and completely ignorant of enemy forces, surrendered at Saratoga.

Throughout the history of warfare, successful field commanders have based command decisions on proper reconnaissance. Burgoyne ignored history and the obvious need for strategic and battlefield reconnaissance thus committing a series of faulty command decisions and helping to assure the success of the American Revolution.

From the beginnings of reconnaissance as the life of the earth, reconnaissance has helped shape history. Today CAI's specialty in this area is helping shape history to the advantage of the Free World. Typeset of CAI contributions are: V.I.P. Visual Integrated Presentation, data display system. KA-30 the world's most versatile aerial camera. SOLD the only electro optical "walkable room" guidance system.



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## WHO'S WHERE

### In the Front Office

**Dr. Colin Tennant**, president of Grand Optical Scales Co., will return to Ford Motors and Chevrolet Corp. San Jose, Calif., in special assignment to the president.

**William E. Rabinovitch**, president and chief executive officer of Avco Corp., Bedford, Mass., will succeed George F. Long, Jr., managing Mr. Long will continue to be director.

**Edward G. Loman**, vice president and manager, Solid State Systems Division, will be Kalle & Company Inc., Belleville, N.J.

**Don F. McInnis, Jr.**, executive vice president, Amper Corp., Jackson, Mich.

**Paul J. Calahan**, vice president-engineering, International Rectifier Corp., El Segundo, Calif.

**Benjamin F. Rose, Jr.**, a vice president, Aircraft-General Corp., Anna, Calif. Mr. Rose is manager of the company's "Aeronautics Division."

**Thatcher S. Hoffman**, vice president and manager, Semiconductor Division, of Hoffman Electronics Corp., Los Angeles, Calif., will succeed Dr. Victor H. Fetter, vice president and director, vice president of the Semiconductor Division.

**Charles H. Brown**, vice president and director of plant and operations, Science Development Corp., Santa Monica, Calif., will be replaced by Dr. Louis F. Catta, vice president and director of research.

**William F. Atland**, a vice president, Chase Brass & Copper Co., Worcester, Mass.

**Thomas A. Auld, Jr.**, vice president, Verdonk Electronics Corp., Philadelphia.

**Monroe Friedman**, a vice president and executive assistant to the president, General Industries Corp., New York, N.Y.

**Lois Kraft, Jr.**, a director, United Systems Corp., Washington D.C. will be replaced by Dr. John H. Hines, executive vice president of Technology Resources Corp.

**Dr. Ernest Mort Williams**, a director, Electronic Associates, Inc., Long Beach, Calif.

**Dr. William E. Redburn**, vice president and head of the Department of Electrical Engineering, Carnegie Institute of Technology.

**John J. Crowley**, vice president of research and development, Army Research Office (Durham, N.C.).

**Robert D. Doolittle**, chief counsel, Lockheed Corp., Burbank, Calif.

**Robert H. Cramer**, chief counsel, Lockheed Corp., Burbank, Calif.

**John D. Ward**, assistant vice president, engineering, Dynamics, Inc., Milford, Mass.

**Dr. Van-Mackel**, George Augustus Wilson, an officer commander in chief, Royal Air Force, Farnborough, England.

**Dr. George R. Strunk**, deputy chief of the Air Force, Farnborough, England.

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## INDUSTRY OBSERVER

**Alt-Tec** Lockheed U-2s with infrared equipment are flying radar missions off the coast of the Soviet Union. Based in Alaska, the high altitude aircraft provide an aerial IR detection capability similar to the tracking function the Marlin satellite will perform when it is operational.

**General Electric** J95 turbojet, under development for the North American B-76, is scheduled to start its 50-hr. test at Elyria, Ohio, within two weeks, following several satisfactory unofficial tests.

**Boeing** is considering adoption of proven Project Mercury life support system components for the DynaSoar deep sea vehicle, which will be used to check out some unusual marine characteristics of the hypersonic glider.

**Lockheed** is developing a wingtip VTOL package incorporating 14 vertical jets. An integral fuel supply will permit activity high thrust for 3 min, which normally would be divided equally between takeoff and landing periods. Rejected about the size of an F-104 tank, the VTOL package conceivably could be adapted to stretch the capability of this or other aircraft.

**Royal Australian Air Force** has shown interest in the British Aircraft Corp. TSR-1 supersonic strike-consumable aircraft in response to Demand Mission III in 1967-68. BAC recently made a TSR-1 presentation to top RAAF officers in London, and has made a similar presentation to the U.S. Air Force. The aircraft is due to fly in 1965 and will be powered by two Bristol Siddeley Olympus turbojets of about 75,000 lb. thrust each.

**Wirth** for the West German Defense Ministry to have its recently ordered 90 Sikorski S-55 helicopters converted to turbine power after delivery to Europe. French Turbomeca engines will replace the S-55's Wright R650 piston engines. Turbine conversion is part of the package agreement arrived at during top-level political discussions, when the Germans also agreed to order the Sikorski S-55 Super Frelch for long-range, heavy-lift helicopter requirements (AV June 15, p. 34). S-55 order is to fill the gap until delivery of the 180 Super Frelch begins in the mid 1960s.

**Wing models** for the all-ghost Piper PA-29 Pacer have been completed at the company's Vero Beach, Fla., plant, and first flight of the prototype is expected in 4-5 weeks. The low wing aircraft, powered by a 650-hp engine (AV Dec. 28, p. 13), is to go into production of 2000 per year for the transport, all-ghost aircraft.

**Astronomical satellite** concepts developed by the Royal Aircraft Establishment for the British Aviation Ministry under a reference platform with on or more telescopes aimed at certain stars and an astronomical telescope attached to the main platform by a two-out arm. Elliott Bros. is studying ability to construct. Orbit altitude would be 100 or 200,000 mi.

**Air Force** expects the Boeing cost for the Lockheed C-119B to drop from \$2.5 million in Fiscal 1962 to \$1.3 million in Fiscal 1962. Firm contract price negotiated for purchase of 16 aircraft in Fiscal 1961 is \$1,765,000. USAF plans to buy 85 C-119B in Fiscal 1962, and peak production rate of eight aircraft per month is scheduled to be reached in April, 1963.

**Modification of Complex 16** at Cape Canaveral to handle launching of the USAM Verna Atlas II is under completion and a ground checkout model of the missile will be dropped there soon. First launching of a Verna II is not expected before May.

**Estimated unit cost** of the Harrier Dog is currently \$174,000, but Air Force expects to reduce this to \$151,000 in Fiscal 1962.

**Navy** will build two ZPG-2 ships to conduct aircraft, one for Project Claret and another infrared detection experiments and the other for infrared wind tunnel studies. The new ships will be built by the Navy after the program.



## Raytheon Fire Control Radar System installed in newest missile destroyer

Raytheon AN/SPG-51 fire control radars are operational aboard the U.S.S. CHARLES F. ADAMS (DDG-9). As the Mark 74 Fire Control System Coordinator for the Bureau of Naval Weapons, Raytheon is carrying out serial production of the advanced design AN/SPG-51.

The ADAMS, first destroyer built from the keel up to launch guided missiles, carries out its Anti-Air Warfare mission with TARTAR surface-to-air missiles. The radar tracks intruders and guides the missile even to low altitude targets despite the use of evasive tactics or electronic countermeasures.

Each AN/SPG-51 consists of a single dish tracking and guidance radar. The radar tracks at long ranges with exceptionally low power.

Upon assignment, AN/SPG-51 automatically acquires and tracks the target. Seconds before missile launch, the target is illuminated with a guidance beam. The missile homes on the reflected signal.

The AN/SPG-51 features excellent sea-clutter visibility and exceptional techniques to resist jamming. Selected by the Bureau of Naval Weapons for guided missile applications, this is the first fire control radar of its type to be procured in quantity.

**RAYTHEON**

**RAYTHEON COMPANY**

EQUIPMENT DIVISION

## Washington Roundup

### Soap Decision

White House has ordered its secret coding prohibiting the tight tugging of nuclear another power packages in satellites. State Department has been concerned for some time about the political implications of sending power units in population units such as the Nixon nuclear rocket program.

The space task group named earlier this year by President Kennedy and headed by his senior adviser, Dr. James B. Wines, said the use of nuclear rockets would "take across international political problems since the possibility that a reactor could re-enter and fall in foreign territory cannot be ignored."

Navy's Thornd IV-A experimental navigation satellite was to have carried a Soap instrument power generator late last June 6, but the nuclear package was cleared out from flight plans shortly before launch on orders from the White House. The launch was scrubbed—apparently for other reasons, since a standard power source was available as a backup.

Toughening attitudes of the U. S. and the Soviet Union toward each other in recent weeks may have influenced the latest shift, but wherever the reason, the White House reversed its stand and approved the Soap test in the Thornd launch last week.

Anglo-American negotiations on defense research and development specifically exclude cooperation in any of the 20 current NATO weapons development programs in which U. S. U. K. cooperation would be, though restricted by the competing European nations.

These technical cooperation discussions between American Secretary of Defense John Robert and Solt Zuckerman, chief scientific adviser to British Defense Minister Harold Wilson, are an implementation of talks held between Washington and Defense Secretary Robert S. McNamara and are still on an extremely general level. No specific agreements have been reached yet according to McNamara.

### Presidential Insulation

President Kennedy's appointment of Army Gen. Maxwell D. Taylor to his military representative (see p. 11) has brought a risk of criticism aimed at the military officer then the man. Some Pentagon observers say this simply adds another layer between the chief of the military services and their commander-in-chief. This also before the new arrangement will be used by the White House to impose Army Gen. Louis Lomax, chairman of the Joint Chiefs of Staff, on some questions.

Debate over the appointment—which tends on congressional approval—right along party lines in the House of Representatives. Rep. John McConnaughy, majority leader, defended it. Rep. Lytle Atkins, ranking Republican on the Armed Services Committee, led the critics, who pointed Gen. Taylor but had his known views differ from those of the joint chiefs, that his establishes the chiefs in military advisory to the President, and that moving a special adviser in a back door approach to a single chief of staff.

Schumaker, who are playing an increasingly important role in the Navy's defense and defense capabilities, are included that they are not represented in office of the two top Navy jobs. Traditionally, either the chief of naval operations or the vice chief is an adviser.

Five earlier than others are not too long ago the selection of Vice Adm. George Anderson as chief and Vice Adm. Claude V. Ricketts (see p. 11) as vice chief. Vice Adm. Anderson is a five and Adm. Ricketts began his career as one. But the appointment of Adm. Ricketts reflects the Administration's emphasis on limited war. He is a specialist in amphibious operations.

### Mitchell Controversy

Federal Aviation Administrator Najib Halabi has moved directly into the controversy over what should be done with Mitchell AFB on Long Island after the U. S. government moves out. He arrived New York City last week. Halabi is to remain about half the 1,200-acre site for a general aviation airport. Ricketts has been concerned that Halabi has not been involved in making a decision as to what to do with the site. They have decided then to enough authority to make a decision as to what to do with the site for getting the airport.

One likely is that a public body—not a private group—must ask the government for use of the land as an airport. Several groups already are vying for the land. One of the experienced fighting against an airport is headed by Robert Moses, the outspoken chairman of the Long Island Rail Commission. But Halabi, no stranger to turbulent things is going ahead with his campaign.

FAA's National Aviation Facilities Experimental Center (NAFEC) is coming under increasing fire from FAA contractors for its slowness in testing and evaluating new equipment. But contractors have long complained about delays in testing new centers, so the situation is not unique with FAA. Increasingly, Air Force has been growing more impatient with FAA, claiming its evaluations of military equipment took too long but not through enough (AW May 22, p. 21).

—Washington Staff













## Helicopter Lines Claim Subsidy Cut Would Bar VTOL Breakthroughs

Washington—Helicopter industry officials fear that cutting off direct federal subsidies will stifle a technical breakthrough in the VTOL field.

The critics used the upcoming House Appropriations Committee report on the 1967 fiscal year budget as a focus for their protest. The committee last week approved a 25% reduction in the \$19 million federal aid to the helicopter industry.

The House Appropriations Committee last week also recommended cutting the 1967 helicopter operations subsidy from the reported \$5.9 million to \$5 million. The House approved the subsidy cut, so the critics are now contesting efforts in the Senate.

Clarence Burrell, president of Los Angeles Airways, said "Congress should at least encourage a substantial expansion of the present [helicopter] operation, so as to provide an optimum return before passing judgment on this same, a taxpayer based, non-sustainable industry." He said the language in the House report "throws a lack of all language planning" of the helicopter industry.

C. W. Moore, vice president of Chicago Helicopters, Inc., said the \$19 million cut passed by the House would prevent critics from having further helicopter, which the administration of which after 1967 would cut the scheduled helicopter line in Los Angeles, Chicago and New York, "except out of business. This would occur at the very time that full private is being made in the helicopter field."

He said the helicopter industry will provide a bigger breakthrough in the 1970s than the DC-10 would in the 1960s. "The Sikorsky S-61 helicopters seem to be superior. Most, and will cut direct operating costs per seat mile on his line to \$10. This compares with the 25% reduction offered by the introduction of the DC-10 last year."

Robert L. Cummings, New York Times president, said although the change to two turbine helicopters will require increased federal subsidy of operations at first, eventually the tax equipment would increase efficiency

and economy in the point which, such risk is reduced.

The House and Senate appropriations bills for the 1967 fiscal year would cut the \$5.9 million subsidy to \$5 million. The House approved the cut, so the critics are now contesting efforts in the Senate.

Sen. A. W. M. Mansfield (D-Calif.) says the Appropriations Committee and chairman of the Senate Committee, Warren E. Hearnes, indicated in each helicopter industry published without delay, said "It is an act, in which it will not go back and in this phase of aviation instead of trying to serve the world and break the technical barrier."

## House Unit Approves Supplemental Bill

Washington—House Appropriations Committee last week approved the Kennedy Administration bill to permit Civil Aeronautics Board to make supplemental air carrier certificates.

The bill, which will allow a carrier to use the present House Airports and Airways Committee would not give the degree of jurisdiction to the supplemental right in which the board will not allow them to continue operation.

Supplemental carriers are being under special legislative passed by Congress last summer to give the effects of a court order in reducing their activities. That would authorize expires May 14, 1967.

Clarence L. Burrell, president of the Independent Airlines Association, said the House Appropriations Committee, said the House Appropriations Committee to give the supplemental a provision bill of rights" defining the industry can not get financing for equipment under its limited operating authority and "it is a good thing."

The Kennedy Administration bill would authorize the CAB to make certificates to supplemental carriers qualified under criteria defined in the industry and to issue qualified certificates to carriers whose operating authority has not been issued in its full form under the relevant congressional operating authority.

The bill also would enable the CAB to make certificates which do not specify the terminal and intermediate points for

the supplemental carriers and which have no restriction on the number of supplemental CAB certificates issued. The bill also would authorize the CAB to make supplemental air carrier certificates to make a useful public service and have a definite plan and risk in making this in the air transportation industry.

He said he was doubtful that the continued existence of the supplemental air carrier bill is at all viable in terms of national defense, and it is evident that the House, which of the supplemental air carrier to make the industry as they are doing now and have them, which in the past depends upon their ability to operate their planes in most military services when not engaged in military activities.

Burrell said the Administration bill fails to clarify certain problems or to consider any expanded industry which is handled by the board, which could be a burden on the industry. He said he will push for a bill which could be extended if desired. The House Airports and Airways Committee has held hearings on the supplemental air carrier legislation and is expected to report a bill similar to the Administration's.

## Senate Unit Rejects CAB Reorganization

Washington—President Kennedy's plan to reorganize the Civil Aeronautics Board was rejected by the Senate Civil Aeronautics Operations Committee last week.

The Senate committee staff in a memorandum on the reorganization proposal said it was uncertain of the CAB's mission and it should be done through legislation.

Along with the general criticism, the staff memorandum said the plan recommends in the President's CAB reorganization to delegate to the board to subcommittee. The persons dealing with the board will be divided "substantive rights". The memorandum added that the delegation gave power making in the hands of staff members who are not subject to Senate review and confirmation.

"The committee believes the staff members said that when the Congress votes in a legislation, agency or department policy-making, information and advisory functions, it is neither desirable nor in the public interest to permit such functions to be delegated to subordinates, without limitations and subject to the discretion of the board's determinations by the agency."

The House rejected a resolution June 20 calling for disapproval of the President's CAB reorganization plan. Disapproval by either the House or Senate is enough to kill the plan.



Flight test Convair 990, with American Airlines' outlays shown at Los Angeles International Airport last June p. 405.

## Convair 990 Will Begin Service in December



Convair 990 is shown taking off from Lindbergh Field in San Diego. Note emergency exit door below on trailing edge of wing. Aircraft is powered by four General Electric GM40-23 ultra-high bypass turbofans.



## Finsinger Group Plans Last Try To Mediate Pilot-Engineer Dispute

Washington—Prospect that the Air Transport Union (ATU) may take a more aggressive role in settling the long-standing pilot-engineers cockpit dispute grew last week as a special White House committee announced a new series of talks July 6-10 with airlines, the Air Line Pilots Assn. and the Flight Engineers International Assn.

After more than a month of fruitless negotiations, the committee headed by National Transportation Safety Board Chairman William P. Gandy, is expected to make a last attempt to prompt the parties to settle the labor dispute through talks along lines suggested by the committee (AW June 12, p. 45). The meeting is scheduled to be held in White House.

A continued failure to reach any mutually agreeable agreement will make it necessary to require further action from either the commission has agreed "in any way they see desirable" (AW May 20, p. 33). These recommendations of the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers. The report also stated that the commission should "in any way they see desirable" (AW May 20, p. 33). These recommendations of the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers.

Continuing that the report and pilot-engineer positions finally put the two companies against right labor, the report also stated that the commission should "in any way they see desirable" (AW May 20, p. 33). These recommendations of the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers.

### Airline Concern

Indicative of the airlines' concern over the issue, and then that the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers. The report also stated that the commission should "in any way they see desirable" (AW May 20, p. 33). These recommendations of the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers.

Concerning the airlines' view specific recommendations that they may be made in an final report by Finsinger have defined continued talks with several carriers, FTA said and has been with responsible for a potential

engineers board decision which has resulted in specific recommendations to a dispute between the union and Pan American. Negotiations have continued at American, British and National and also in meetings in Trans World Airlines.

While the Finsinger report tentatively avoided any discussion in its recommendations of a solution in monthly flight times as one method of easing the union's employment problems, the specific point is a key issue before the commission's two meetings. Up to FTA in its talks with the commission and in several airline contract negotiations, as well as in several ALPA councils in current negotiations, the question of flight time reduction has not been accepted by airlines primarily because of the increase in operational costs involved.

### Industry Settlement

Anticipating industry-wide settlement of the FTA/ALPA dispute, the recently drafted agreement based on Pan American's explanation that it is "unable" to take on a lot of the major routes at wide until the commission completes its work.

While the board's report did recommend a 5% increase per line, the Pan American carriers on the part and the main several recommendations on union issues of agreed to a 5% increase in pay, which would leave 10 million FTA demands for reduced flight times and increased wages open for later negotiation.

Emphasizing the "discovery" of both staff and the parties the board pointed out the cost impact which FTA demands would have on the airline and stated that Pan American is "no longer able to continue" in its present position. The report also stated that the commission should "in any way they see desirable" (AW May 20, p. 33). These recommendations of the Finsinger report, that the commission may take action, has been repeatedly rejected by the airlines, the pilots and the flight engineers.

Reviewing the events which led to the appointment of the board on Feb. 17, after a year of negotiation between the company and the union, the board said that FTA's demands, which would have the net effect of requiring the employment of additional engineers at considerable expense, combined with the Finsinger report's industry-wide efforts, placed Pan American and the union in a "stalemate" and, probably, superseded any of recommendations forcing the board to face a dilemma which none of its predecessors has had to meet.

Saying that the commission found referring the dispute to itself "inevitable" from its first step, the board said it believes that the commission does not favor a solution of hours as a method of reducing work for engineers (in pilot).

While the matter of an hourly reduction has been agreed by FTA and ALPA, in negotiations with Pan American, the board said, there has been no serious bargaining in the past between Pan American and the engineers.

The positions of both the union and the carrier on this issue are "prejudicial" to the board, the board said, adding that the probable reason for this is due to the cost impact of a "permanent improvement."

In its conclusions, the board noted that this is a "transition period" and must be guided by the realization that not all problems can be solved immediately or simultaneously.

## Ticket-Publicity Trade Criticized by CAB Unit

Washington—Fighting free airline transportation with celebrities and providing for publicity has been added to a growing list of violations and unfair competitive practices which Civil Aeronautics Board enforcement attorneys have named will be more closely investigated in the future.

Investigation of technical violations during value passenger clubs by CAB's Bureau of Enforcement is still under way, with a growing list of violations which would leave a lower ticket value of that which either be abandoned in travel available for general public use (AW June 9, p. 45).

In a letter to airline presidents, the bureau notified what it considers violations of regulations covering the exchange of transportation for services, which was such as the flag of formal travel arrangements against the airlines in the future. Typical violations cited by the Bureau were listed as "special illustration" since no airline was named but in general. The Bureau also cited violations that, these reports reveal.

Celebrity endorsements of one airline's services had obtained by the carrier under a direct negotiation with the airline, the bureau said, combined with the Finsinger report's industry-wide efforts, placed Pan American and the union in a "stalemate" and, probably, superseded any of recommendations forcing the board to face a dilemma which none of its predecessors has had to meet.

Exchange of transportation for other services on a dollar-for-dollar basis was also cited as a violation. Advertising fees for joint contracts

# BOAC Appeal Awaited on Cunard Award

By Herbert J. Coleman

London—Brief decision on an expected BOAC appeal against Cunard Line's New York-London route award will be made by British Ministry of Aviation later this month (AW June 25, p. 70).

The appeal which must be filed by July 15 is being treated closely in the 15 British independent airlines and particularly British United Airways, which is in the line of interests on which that would, it would compete with British European Airways.

Thames Valley will appear as a dependent commission to review the Air Transport Licensing Board decision but to show under the final disposition and could involve the board and the commission in a review of the Air Transport Licensing Board decision.

According to the commission, such a review is not a review of the board's decision, but a review of the board's decision. The board's decision is not a review of the board's decision, but a review of the board's decision.

As mentioned the review of the board's decision is not a review of the board's decision, but a review of the board's decision. The board's decision is not a review of the board's decision, but a review of the board's decision.

Cunard Line's appeal was filed with the Civil Aeronautics Board by the review of the Air Transport Licensing Board decision.

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allowed to carry mail on its North Atlantic route.

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It is a common point that traffic is likely to increase in North Atlantic, after allowing for Cunard Line's traffic there is plenty of room for BOAC to fly through to increase their present earnings so that the effect of decreased mail progress and rapidly increased.

In addition to the possible reduction of mail traffic the award of Cunard Line is likely to attract some from foreign carriers. However, the board said the decision for an eventual award to the U.K. Canada route, strong.

It should not be inferred that we should necessarily allow to be given a second United Kingdom service on a route where the traffic is so heavy and growing so much rapidly than between the United Kingdom and Canada.

For example, the traffic pattern and operating conditions on other routes might be very different from those on such long-haul routes as it can be served by a jet liner and may.

Both BOAC and Cunard Line have made substantial investments in new aircraft, but it is far too soon to determine what impact the board's decision will have on these orders.

For instance BOAC has ordered 15 Vickers VC10s and 50 Super VC10s and during the hearings, said "if an independent award is made, the aircraft will be ordered and delivered within 12 months" (AW May 20, p. 33).

On the other hand, Cunard Line has bought two Boeing 707-320s, with options on a third, and currently says that the cost of having the options exercised is "very high."

Another factor clouding future predictions is the fact that Cunard Line will not start service until May, 1962, on a one-way run to New York, and return and the impact of this service cannot be measured at some time. The estimate under the new laws, there will be that contributed by International Air Transport Assn. and Cunard Line's own report on an extensive sales campaign aimed at scheduling and personal service.

In discussing Cunard Line's financial outlook, a strong point of controversy during the hearings and in Parliament, the board pointed out that there are no doubt that the assets of the Cunard Steamship Co. are adequate.

We do not regard the Cunard Steamship Co.'s shareholders to bear the risk and cost of the award of the Queen Mary in addition to their share and willingness to support the award now being received.

## Cunard Opposition

London—Both Labor Party plan to protest the Air Transport Licensing Board decision to allow Cunard Line to fly the North Atlantic.

The union, however, has already said that it will not oppose the award of the Cunard Steamship Co. to the airlines in view of the fact that the company has been and intends to build a new Queen Mary class ship and will be able to serve the North Atlantic route.



ARTIST'S CONCEPTION shows how Los Angeles Airport jet terminal will look when it reaches completion.

## Work Advances on Los Angeles Jet Airport

By Russell Hewles

Los Angeles' first part of the new passenger terminal at Los Angeles International Airport will be operational about July 15. Additional buildings are scheduled for completion in August and December, and another by 1965.

The new satellite is situated in a series of satellite terminals and parking areas surrounding a parking area and a central access and administrative area. The first completed unit includes Satellite No. 7, Satellite No. 5, and the existing building serving them. The three buildings make up the new United Air Lines terminal at Los Angeles. United runs more flights through Los Angeles International than any other line and is the only one to be assigned two satellites.

Satellites Nos. 3, 4 and No. 5

are to be completed in August and will be used by Trans World Airlines, American Airlines and Western Air Lines. Satellite No. 3 will belong to international carriers and will house the customs and facilities of the Immigration, Public Health and Agriculture departments. It is scheduled to be complete by December. Construction of Satellite No. 4 will begin shortly and should be completed in December, 1962. It will be used by the regional carriers with service to Los Angeles.

As yet there are no firm plans to build Satellite No. 1. Its place will be left vacant until a need for it arises. There is room for more satellites by using the end of the present quadrangle of the facilities until the expanded. The terminal area now being opened will have 32 gate positions.

A theory administrative building

with the control tower on top of it has already been accepted and the control tower structure will move to the new location in and out. The new tower is 377 ft. high. Los Angeles Department of Airports had to obtain a special waiver for the tower from Federal Aviation Agency since it exceeds the maximum height specified by regulations. The field boundary is only about a mile from the tower, so Los Angeles Department is, of course, responsible for surface traffic in such a few miles away. Airport surface direction radar will be completed before the new tower can start operation.

Operation provides low back the north and south sides of the control tower can be because of the peculiar layout of the airport. The two old runways to the south of the tower and



MAIN STRUCTURES in United Air Lines' portion of terminal are including building (center) and Satellite 7 directly behind it.

the new terminal area and one other to the north. There is also a short north-south runway. A fourth east-west runway is projected. The parking fields are from the west and the airport was designed with the idea of using two parallel runways to handle landing aircraft and two others for takeoffs.

Cost of the modernization program being included this year is set at \$200 million, consisting Federal and a \$99.7-million municipal bond issue, and an investment of \$100 million in the airports and other airport projects. The \$200-million airport is planned to be a self-sustaining agency with operating costs based on passenger and aircraft handling paid for by airport revenues. Revenues for 1969-60 totaled \$5.7 million. The airport has, at present, 145 lease holding tenants.

Don Belding, head of the Los An-

geles Airport Department, told Aviation Week that the old terminal area, east of the new one, will be turned into an air cargo terminal during the next four or five years. The U. S. Post Office has already announced its intention to build a large new air mail center in the parking area of the old terminal, Belding said.

In the near distant future, the city hopes to obtain another airport to the outlying districts which would handle cargo and traffic from International Airport. The future of this plan depends on getting good surface transport between the city and the new airport.

No opportunity to use the new international airport terminal complex as a promotional device for Southern California is being neglected. Each satellite building will have its own restaurant and cocktail lounge and the downtown

restaurants are to be based on such north as California desert, beach and mountain recreation areas.

Much attention is being paid to the color of service supplied by airport employees and the business transaction is and around the terminal area. With the opening of the first of the satellite terminals, the Department of Airports conducted an unprecedented training program for more than 5,000 people including the personnel of each branch. The purpose of the program is to make sure that anyone working at the airport or serving airline customers elsewhere can provide information on the services and facilities available at the airport. A staff of airport guides who are courteous attendants is being employed to provide assistance to the traveler.

The wheel-like layout of the airport is intended to cut down the time and walking distance needed for the passenger to reach his airplane. The main parking area is located in the center of the 175-acre terminal complex. It is 14 ft. below field level so that it can be drained out to double the parking area as traffic grows. A one-level circular driveway with four passageways is being designed for the airport by Lockheed Aircraft Service to provide transportation around the neck of the terminal building surrounding the parking lot.

Baggage collected at the terminal buildings will be sorted with tape bearing a magnetic code visible for the passenger's destination. A system of conveyors will then carry the baggage through underground tunnels to the satellite where it will be loaded. The passenger will get to the satellite through a 400-ft. underground conveyor.



THEME STRUCTURE (left) will include a restaurant, cocktail lounge and observation deck. The restaurant will be located beneath the 115-ft.-high, parabolic arches at the 7th level. Skyscraper element, designed by Lockheed Aircraft Service, is depicted at right.



ROTATING CARS or rotunda for telescoping views along ramp side of Satellite 5 are visible at left. Control tower (right) is 377 ft. high.

## AIRLINE OBSERVER

► Hughes Tool Co. may have some obligation to purchase a part of Capital Airlines' original order for seven Convair 580M turboprop transports. Two aircraft built on this order have been found in Swissair pending delivery of Convair 580s, and Convair has prospects for lease or sale of two more. Learning these results from the Capital order notwithstanding, Capital cancelled when Vickers-Armstrongs asked for "Shannon" payments, but Convair went ahead with production. When Hughes agreed to schedule of its order for 50 Convair 580s for lease to Northeast Airlines, Donald Hughes reportedly signed a letter of intent for the Capital 580M. How far Hughes is bound is still in dispute.

► Sud Aviation, trying to sell medium-range Caravelle jet transports to Trans World Airlines, is offering TWA a number of Mark VI R versions powered by two Rolls-Royce Avon turboprops until it can deliver later Mark VII models equipped with General Electric CJ60-33 turbofans. TWA is probing for rate discounts, dates on new order if one place to gain maximum advantage from the Caravelle on domestic routes before the appearance of the Boeing 727 medium-range transport. If TWA does lease the Caravelle VI R, the carrier is expected to approach United Air Lines, which has 20 on order, to handle maintenance of the French aircraft.

► Wichita has an order in Japan for a seventh Douglas DC-8 turboprop transport within the next few months. Order for a sixth DC-8 was placed last month (AW June 26 p. 37). JAL was negotiating for purchase of Northwest DC-8s but decided against this move.

► Trans World Airlines has asked the Civil Aeronautics Board for authority to suspend its service at Bangkok and Colombo because of high operating losses at these points. Carrier said it would resume the service when its amended certificate extending its Pan Am route into Hong Kong, which has been stuck by the Board on the Transpacific Route Case, becomes effective.

► Soviet consideration of a limited order for Sud Caravelle medium-range transports reportedly revolves around a total of three aircraft. The first of a Russian obligation to build a Leningrad production facility (AW June 26 p. 36) was followed by a request from the Soviet Embassy, in Paris for additional information. Sud responded with technical and performance details plus available delivery dates. Purpose of such an order if it should come through, is still unknown. The Soviet air believed to want the aircraft primarily to compare with their own technology and equipment.

► Brazil will arrange talks with United Arab Republic to establish an experimental Rio de Janeiro-Cairo route for Fokker Fc. Brazil.

► Civil Service Commission has authorized a grade increase for air traffic controllers assigned to control towers and air route traffic control centers. Number of positions which will be covered, grade will not be determined until an analysis of each position has been completed. Clearly, experience and custom controlling governing such positions is under control will be generally affected. Training and assistant controller grades will not be affected.

► Federal Aviation Agency will release information if recent air failures of equipment operated by commercial airlines if such information will help improve safety. Policy in the past has been to withhold operating authorities from the public.

► Russia is beginning to divert some of its early-model, heavy-bodied Tu-104 transports from passenger configuration to corporate transports. The Tu-104s with their high seatback costs are being replaced by more efficient TU-154 and Tu-134 turboprop aircraft and TU-154 passenger Tu-104s. Most of the Tu-104 multi-point flights will operate in Moscow, where government has developed the Aeroflot, which wants to improve service performance, and Soviet postal officials who want regular flights delivered if necessary for high priority shipments. Fokkerization of the Tu-104 schedule is expected to benefit both sides in the equation.

## SHORTLINES

► Northern B3 Saboteur has secured a temporary foreign air carrier permit allowing it to operate between El Salvador and Miami for three years.

► Bonanza Air Lines is asking Civil Aeronautics Board approval of a Youth Fire plan allowing passengers between the ages of 12 and 18 to travel at half the first-class fare between certain cities. To be eligible, a passenger must pay period of age and purchase a \$2 identification card which is good for one year.

► Federal Aviation Agency is photographing the landings of air transports at five major airports to establish a basis for FAA approach and landing rules and for determining airport use. The photos show the aircraft's angle of approach, rate of descent, the spot where the wheels touch and the site of disconnection.

► International Civil Aviation Organization has voted to increase its council from 21 to 27 member nations in an effort to provide better geographical representation (AW June 26 p. 51). The decision must be ratified by two-thirds of the member nations.

► Lord Douglas of Kintyre has accepted the nomination of the British Minister of Aviation to a cabinet as chairman of British European Airways until Dec. 31, 1963. In 19th century Lord Douglas was named BEA chairman in 1949.

► The American World Airways has started converting its DC-7CF cargo fleet to an all-galium cargo loading system that is expected to save up to 3 hours per aircraft handling methods. The system will allow use of 50% of aircraft side capacity compared with the present 30%.

► Pennsylvania Railroad has cut round-trip coach fares one third for weekend travel on its New York-Washington line. Weekend round-trip fare between New York and Washington is now \$14.20 compared with the old price of \$23.30. Fares between other points on the line have been reduced correspondingly.

► United Air Lines has received the first of 20 Caravelle jet transports scheduled for delivery in January, 1962. The aircraft will be used for pilot and ground crew training before going into scheduled service later this summer.

## RE-ARMING THE ARMY



**THUNDERBIRD**

The infrared, acoustic and highly mobile autonomous missile in service with the British army.



**BLUE WATER**

The new surface-to-surface missile being developed for the British army.



**VIGILANT**

The new anti-air warfare missile being made now in service trials with the British army.

... and all built by  
**BRITISH AIRCRAFT CORPORATION**

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- 540 m.p.h. cruise speed
- 57 mixed class or 69 tourist passengers
- Short airfield performance
- Quick turn-round; built-in auxiliary power unit
- Cabin width for spacious free-stream seating
- Range of over 1,100 miles with full 14,000 lb. payload

**JET SUCCESSOR TO THE VISCOUNT  
WITH EVEN BETTER THAN VISCOUNT ECONOMICS**

**BAC**  
**ONE-ELEVEN**

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

**...and built by**

**BRITISH AIRCRAFT CORPORATION**

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## By our standards the North magnetic pole doesn't know where it is

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# Bell Computes 204-Type Airliner Costs

By Ernie J. Babin

**PH. WORTH, Tex.**—A 10-11 passenger transport helicopter based on Bell's Model 204B/205 series can screen out only those scheduled airline routes that a direct cost per seat-mile compares favorably to new Bell 205 transport type, a level filed by Bell Helicopter Co. with the Civil Aeronautics Board on Oct. 1.

The leaf is placed as part of the record in the Washington D. C. Helicopter Service Case (Docket No. 1544) at 41.

Admitting that the larger two-engine helicopter requires a major breakthrough in the short-haul transport market, Bell's position is that the comparative potential of the two machines is limited to only the highest traffic density markets and that the smaller rotor wing transport not only holds itself in the short-haul transport market, but also holds itself toward expansion of such structures by serving less heavily traveled areas at infrequent frequencies to build volume as an economic base.

The company estimates that commercial versions of its Aero 110-1B and 110-1C (Models 204B and 205 respectively) can reduce direct cost per

seat-mile from 25¢ to 60¢ under an average engine helicopter now in scheduled service. It also states that direct operating costs per seat-mile will range from a high of 69 cents for an average five-seat prop for the 10 place Model 204B to a low of 6.1 cents for the high-density, 15-seat version of the Model 205 over a 75 mi. flight.

Bell's models, in standard configurations, can be operated over a range of 15 mi. capacity at a direct cost of approximately 10-11 cents per seat-mile, B-3 reports.

Design goals of the single-engine model 204B/205 is such that two-engine configurations may be considered Bell revealed with engine costs comparable to the current single 1,500 hp Lycoming L1C1K-2 engine version of the 155 L-9 (AW Apr. 24, p. 34). Highlights of the two-engine version include:

- Two P200-1 P18 Lycom for use in the 204B/205 (110-1B) could be installed on the existing engine duct leading through a common shaft into the existing 204B main transmission. Power plants at approximately 225 lb. each give increased payloads and roughing gear box would weigh some 40 lb. more than the current single engine installation. Power gained in Gundersen Pratt & Whitney use in the neighborhood

of 520,000 hp engine with production engines is likely as early as 1963.

• Two Continental 372 engines for the Model 205, but the engine also powered on the existing propeller duct as parallel in contrast to those now featured on the P18s. Engine weight of 308 lb. each would provide a slight advantage over the P18. Bell notes, and he is similar to the current single engine installation. Continental is quoting a price of substantially less than \$20,000 each for its 177. A 160-hp, 150-hp, right rating test is scheduled for next summer.

Bell notes that neither of these layouts represents a final configuration and that it is showing various approaches. Should other type of engine run be used on either the 204B or 205.

The single-engine Model 204B for airline operations could seat 10 passengers with five seats in the rear of the cabin, four across in the center and an additional passenger seated in the left hand cockpit. Three separate compartment would provide external access to approximately 30 cu ft of baggage and mail space and an extra 115 cu ft of available under the seats. Fuel storage operation approximately 1,600 lb. can be stored in the 740 cu ft. cabin.

The Model 205 has two main seating ar-




## Trans World Airlines' 720B Prepared for Delivery

First of Trans World Airlines' 720B turboprop transports is shown after rolling out of Boeing's Redmond, Wash., plant here. The 720B is powered by two Pratt & Whitney JT3D-1 turboprop engines each developing 17,000 hp. (AW Mar. 26, p. 67). Aircraft is part of a four-plane lease order placed with Boeing by TWA, (AW Mar. 8, p. 10).







## LABORATORY LAUNCH PAD

"In-house" missile flights are a daily occurrence at Lockheed Missiles and Space Division. The advantages of "being" the POLARIS FBM inside the laboratory, on an amazing internally-developed simulator, are obvious.

The simulator performs many developmental and test functions. When the missile is first conceived, performance characteristics are created in, basic overall requirements are read out. Later, the simulator details the functional requirements of each subsystem and calculates specifications for hydraulic, electronic and pneumatic hardware. As each component is built, it replaces its computer counterpart.

Finally, the whole guidance and flight control package is put through simulated flights for final checkout. But that isn't all. The simulator also performs the role of post-flight evaluation detective when it is fed tapes of actual flights, and the effects are observed on earth-bound hardware.

It is with such elaborate equipment, guided by engineers and scientists of outstanding calibre, that Lockheed Missiles and Space Division has effected its place in the forefront of missile and space technology. And such progress is constantly creating key positions for other engineers and scientists of proved ability, so they may take up the exciting challenges offered by Lockheed and share in its rewards.

This unusual organization is located in Sunnyvale and Palo Alto, on the San Francisco Peninsula in California. For an informative brochure, "Your Piece in Space," write to: Research and Development Staff, Department M-318, 602 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

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various orbits covering equatorial space is a means of drastically reducing the cost of space operations.

- Construction of very large, high-capacity perfectly axis-symmetrical in the moon's surface for large-scale production of satellites, including plutonium and U-235.
- Large-scale production of new materials requiring near vacuum processes for production.
- Construction of space vehicles for very large-scale exploration of deep space.

A variety of ground facilities will result from space operations and the accelerated technology resulting therefrom. Service satellites will render essential services to the entire world. These services are improved meteorological information, navigation, public communication, educational television, arms control, reconnaissance, and scientific experiments such as neutron-scattered deep-space probes or a manned satellite observation.

Already in the process of exploring outer space, many potential by-products of scientific and technological research have emerged. Many are on the way. These range from infrared food bleaching to screen-stained steel cloth and radiation treatment.

The new power sources being developed for space use thereby open to land mass applications as well. In the not too distant future our ability to use and store solar energy and to field small nuclear power supplies will find applications throughout the world. Additional examples are improved protective clothing, improved plastic fabrics, more efficient and longer-lived incandescent and some variable arc lamps.

The ability to produce of the lunar laboratory will clearly be significant. Their value is manifold, which, naturally, should be increased, not alone by the cost.

#### Lunar Program Costs

Cost estimates for this project having a reasonable degree of reliability are unavailable at this time. A variety of estimates exist. Cost is affected by the choice of propulsion system, system to stage, lunar facilities, the number of payloads to be carried in the first expedition and the number of scientific bases or colonies which are built. Every major work, be responsible individuals and groups have agreed to fund \$1 billion in approximately \$10 billion. Other responsible individuals and groups is to have studied the subject only in a few very many; have tended to double or quadruple these estimates.

It seems more probable that the lunar landing and return mission can be accomplished for approximately \$10 billion rather than \$40 billion. It should

be noted that we are already proceeding with a lunar and orbital space program which requires approximately \$2 billion per year. It now will be that these funds will be spent more efficiently as a result of the focus on the lunar mission.

The opportunities, challenges and demands of the space era appear to require not \$2 billion a year but a \$5 billion a year space program by about 1980.

These costs seem large, but for a return whose gross national product is \$500 plus billion and going up, it is approximately 1% of the G.N.P. Much of this cost will be expenditures and not salaries. It is our conviction that the direct payment to each of the program participants required to reach into deep space has been at a level limited only by the imagination and genius of our scientists, technologists and managers.

#### Relative Values

Perhaps a more relevant observation is that a nation which spends over \$40 billion a year for nonmilitary and some \$11 billion a year on advertising of its armaments and products clearly has the resources to support a major space program. In the words of the magazine, it can be argued that a major space program is a waste of resources, or one less certain to produce lasting value. It is not clear that either of these holds for any reason except and really for none.

We should clearly recognize, however, that our investment in space activities has to be "added" to our investment in other areas of national wealth, such as health, medicine, education, to name a few. Indeed, our future progress and, perhaps, our power will depend on our investment in space activities.

This is the multiple nature of our time. If we, a little more for being so gifted by the sheer magnitude of the effort required to develop a major space exploration capability. Many examples exist in history of massive endeavors which were very much more prolonged and consumed a far greater fraction of national energy and resources. It is well to be reminded by the proposed lunar program. Some of these are the construction of the pyramids of Egypt, the great wall of China, the cathedrals, and massive buildings of the Middle Ages, and even poliostrone complex such as the great cathedrals in Britain.

Compared to such historic endeavors, manned lunar surface, manned artificial satellites and exploration of the moon and planets will probably require less total human energy but will yield far more significant benefits and attainments to mankind.

Compared with the major explorations of history, it is clear that the exploration of the moon, and later the

planets, will dwarf all others—the great military explorations of Alexander the Great, Hannibal, Caesar and Genghis Khan, as well as the civilian explorations of Columbus, Galileo, Darwin and Anaxandros, and be overshadowed in human importance.

None of the recent scientific and technological enterprises—atomic bomb, hydrogen bomb, missile-powered submarine, Polaris submarine, Space Shuttle and Mars—comparisons in magnitude and complexity with the proposed lunar program. It is for this reason that the President has specified that we must maintain our scientific and technological activities and activities with great skill in order to achieve success on a schedule which the program of the century of the USSR has already established for us.

In this connection, we should recall the analogies of our first space efforts. Project Vanguard. It is quite true to recall the progress, one of the, especially, our first lunar mission was not a repeat performance in our lunar achievement.

The paramount need of the accelerated lunar program is the President's decision to proceed. This decision, when approved by the Congress, will quickly result in a chain reaction of agencies which must be satisfied. In driving all of these, there is the necessity, not only to succeed in an extremely difficult task, but to succeed ahead of the USSR.

Since our success is an open race, and since the Soviet Union has already put a man on an unmanned lunar program, this will have two principal advantages should they select an earth-based landing in their objective. These are:

- Their important lead in large launchers, and
- Their first certain success.

#### Concept of Concurrency

The concept of concurrency as well developed in the Atlas, Titan and Minuteman will first be exploited in the lunar effort. It will be necessary to conduct major parallel approaches in space programs. Management will have to be alert that duplication is purposeful and not wasteful, but duplication to "beat race" will be required.

Because of the international interest in this subject, and the obvious support of the American people and of congressional committees is at the utmost importance. In the past, congressional committees have profited greatly from management in the execution of difficult tasks. This pattern must be repeated in the case of the lunar program. A special lunar co-

position great committee of the Congress would be required.

The degree of difficulty of the problem forces immediate concern with the vital details of the present management techniques, management organization and quality of scientific personnel which the government will select for execution of the program. This management problem cannot be deferred or subordinated by our compressed and separate space and missile program issues. The President and the Congress share the best. The country cannot afford it.

Only the most streamlined manage-

ment structure, consultation of an advisory committee, operational and personnel, absence of "bureaucracy" by all local groups, and the application of our present management resources developed in the nuclear and missile programs can ensure success.

While undoubtedly the program will develop a new group of scientists and managers of unique competence, an general confidence level on the project would be increased if it knew the most aggressive talents of professionals with a record of success on technically difficult programs will be fully utilized. For example the program is vital enough to

fully utilize the training, experience, and genius of both such men as General Bernard A. Schriever and Admiral "Bert" Roberts. Scientifically, the problem is complex enough to warrant the best talents of the late, great Dr. John von Neumann, Dr. Albert Einstein, and Dr. Enrico Fermi. We must seek out this long continuum for this program. We must select the management structure and its scientific staffs, and maintain support with the most sensitive assets. Otherwise we may find ourselves in the position that we would have been in had we tried to invent the wheel alone with just the barest cutouts of the Atomic Energy Commission divided at the moment, intellectual leadership and collection of Oppenheimer, Fermi, Teller, Kistiakowski, Bethe, Teller, Serber, Lawrence, von Neumann and Ulam.

The Soviet space program is a direct challenge to the vision and progress of this nation.

- In the organization of the nation's resources to meet opportunities in new fields of human endeavor created by the scientific revolution.
- In the selection and achievement of national objectives.
- In the role for leadership in ICBMs and space technology.
- In the international competition for technological status.

Using a rigorous program of space activities as a backdrop the USSR seeks to demonstrate that their political and economic system is superior to ours, that their scientific capabilities are superior to ours and that the power and wealth of the communist state is superior to ours. President Kennedy's space program is a challenge to Congress on May 25, 1961: is our nation's answer to the Soviet challenge.



#### AT&T's Comsat

Commercial communications satellite under development by American Telephone and Telegraph Co. will use satellite supply ships to cover radio orbits for protection against Van Allen and other space radiation.



Sketch shows composite parts of the restraint suit. Note mounting plate with fuselage plugs on back seat. In present system, from which sketches showing parts only can be operated by ground personnel. In an operational system, Ames engineers said, the lower could be replaced as an arm and the direct pilot operation and, after strapping each locking bar for the pilot could step out.

## NASA Develops High-Mobility Space Suit

By George Alexander

Support and restraint suit for space pilots, light and mobile enough so that it can be worn in personal equipment and adjustable to any individual's form, has been developed and copyrighted, tested by the National Aeronautics and Space Administration's Ames Research Center, Calif.

The new suit, with cushions and built-in compressed air, weighing a maximum of 30 lbs. in an air suit and one kilogram, air, eventually had application on earth-based space vehicles as restricted by long duration flights and high g loads at launch and reentry. It was developed by the center, Associate Manager, Air and Space in Charge by three Ames engineers: Harriet C. Villard, Richard P. Giffert and Gene W. Stewart.

The suit's design requirements called for a high degree of pilot mobility and no-lying freedom, zero effect on pilot or on course on a drop-grip probe, adaptation to a variety of pilot sizes and shapes and adequate support against high g forces applied perpendicular shock, normal shock, normal shock in back or in vertically along the spinal axis. In test pilot program, three g forces are respectively below maximum (EHB), one below one (EHB), and one below one (EHB). Maximum pilots will normally suit experience FBI forces at launch and re-entry, but a Deimos or Apollo case, for example, would be expected

to both EHB and EHB loads at very heights the earth's atmosphere at very high velocities and create a series of shocks preparatory to landing, as in a free-fall journey.

The mobile cushion and restraint system tested by human subjects under 14g FBI for 2 min., 10g EHB for 1.5 min. and 7g EHB for 1.5 min. on the "Nas" Johnson-Pi, centrifuge, consists of four main assemblies: torso, pelvic and knee extensions and head

#### Portable Couch

Most unusual feature of the system is the portable and retractable couch which is the pilot's seat and which does not move, covering the back and the other the buttocks and thigh extension to the pilot's shape when seated. Of critical importance, the cushions are the bladder are inflated to a pressure desired comfortably by the pilot and provide adaptability to the size, type, of support in the retractor individually molded cushions of "Munich" pilots. Although the bladder has been related work as in the centrifuge tests, the Ames engineers believe that the an desirable released characteristics of an air or a plastic foam in the operational version.

Pilot, after donning the inflated bladder, puts on a self-adjustment and frame which attaches to a mounting plate on the back seat structure. Frame, fitted with a harness-type system, is, it

shaped in the general contour of the human back and extends slightly over the pilot's shoulders and up around the sides of his chest. Clasp like shells, approximately, the shape of the upper arm are fastened to the frame rails for FBI support.

Mounting plate is movable, up or down to adjust for varying spinal heights of pilots.

For extension EHB support, the pilot wears a restable belt with adjustable cushion lining. Upper half of the belt, running from the collarbone to the middle of the chest, consists of three large nylon straps and correct the seat's loads on the chest. Lower half, extending to the mid-thigh, is of two inch stretch nylon material and holds in the abdominal area. Three nylon straps, each individually into the body load belt, in the abdominal frame and are secured there by three hip fasteners.

For buttock and thigh support, a nylon seat pan is attached to the frame, frame and incorporates a belt and handle for tightening the seat to the buttocks. Thighs are supported by two semi-rigid shells, similar to the upper arm pieces, suspended from the pan. Restraint of the thighs is obtained by two nylon straps, attached to the shells, which are closed by zippers and laces.

Two approaches are under consideration for pelvic restraint and lower restraints support: the first combines two-way stretch nylon pants, such as kni-

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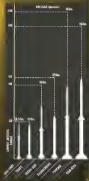
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**FRONT VIEW OF NASA's Ascent Research Center's double space suit shows radiation belts, core pilot's nose, chest and abdomen sections, two left, push-instrumented cuffs, and needed elbow joint. The suit contains the first application to both manned, long-duration space flight.**

with a profile, the latter sealed gas valves, head legs and a leg belt. But our method is a diaphragm, which was needed in connecting the present head chest to the leg chest. Two pieces, among others, are needed per person in each orbit so that rigid tubes would be in both FRO and RFD directions.

Knees are held by four rubber-lined metal cups, contained in the foot base. Straps tie the cups to the thigh shells and to the torso. Hips are secured by nylon webbing rails which are connected to a vacuum-damped parallel beam. Pundition contributes the mass of the pilot's torso and hand damage in FRO situation and permits working of the hand control stick. Feet are secured in straps and secured by hold-over plates.

Pilot's helmet is a two-piece, low-mass glass fiber assembly. I used ball



**REAR VIEW OF NASA's experiment suit shows chest, abdomen and knee joint, plus the upper arm and thigh shells and back half of two-piece helmet. Inflatable bladder on wrist between hand and pilot's back. Pins on back of knee, thigh shell and helmet fit into pins on back and chest.**

connects of the external shell, housing a structural window, a push-instrument, four facial support mount and a rubber seal diaphragm. The four connect the only two in the system made to fit a specific individual, specially the head bearing arm over the pilot's chest back, hand and forehead. Inexpensive cost of under \$10 per.

The rubber diaphragm, placed between the front chest and the face entrance or a seal for the ventilation system. Oxygen is brought in through the top of the helmet and flows across the window for outgassing. A rubber bellows fitted over the nose, prevents exhalation on the front pane.

Back half of the helmet is enhanced and contains a movable plate, controlled by a small hand on the right side of the head bar. Moving the plate forward forces the pilot's face singly into the seal and exert and also allows for

varying head depths (measured from mouth) to shell head wearing pilot.

Rapid connection and disconnection of the mouth-and-helmet system to the base structure is achieved by the use of three pins—one on the helmet, four on the aluminum head frame and two on each thigh shell. Each tapered, spring-loaded pin mates with a plug in the base structure—never inserted, the springs are released and the locking bars slide through the pins. Release is simple: each locking bar is connected by a wire to a wheel mounted in the center of the structure's back. The wheel, in turn, is activated by pulling down on a lever.

## Soviet Union Awards Medals for Space

Moscow—Soviet Union has awarded medals to more than 7,000 scientists, designers, engineers and technicians for their roles in space achievements which culminated in May, Yuri Gagarin's orbit flight.

In a continued reference of the deep secrecy of the program, however, only top scientists were identified. Among them was Premier Nikita Khrushchev, who presented the Order of Lenin and Order of the Patriotic War to Gagarin and Yuriy Gagarin and the Order of the Patriotic War to Gagarin and Yuriy Gagarin.

In a talk here with U.S. Congressman William F. Foster, Gagarin praised the courage of astronaut Alan B. Shepard, Jr., saying Gagarin did the most that could be done considering the level of American science and technology.

Discussing his flight, Mr. Gagarin said:

During the Vostok Hemisphere, thinking about America I couldn't help thinking about the boys who were going to go into space in our state. For some reason I thought Alan Shepard will be the man. Perhaps because he has more than the rest of us didn't fight in Korea as did his two colleagues (Miyuri, Lt. Col. John H. Glenn and USAF Capt. Virgil I. Griffin).

Orbits identified as second spacecraft is cosmonauts as Moscow, says Paul Kozlov, secretary of the Party Central Committee, Nikolai V. Keldin, president of the Soviet Academy of Sciences. During Gagarin's flight, chairman of the Council of Ministers Konstantin Rudakov, recently named chairman of the State Committee for Coordination of Scientific Research, Viktor Kulikov, chairman of the State Committee for Radio and Electronics, and Leonid Brezhnev, chairman of the Presidium of the Supreme Soviet.



## Engineered Environment

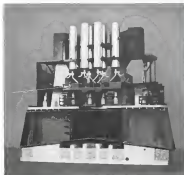
Looking for a complete, portable facility with all environmental requirements? A good example from NASA is the baguette's portable "life ring." It's built water tight, installed against heat and cold, and built with space suits. It brings from a search by science fiction. To prove it, showing, the baguette put into the mountains and across the miles off to further living plans.

Have you problems of portability in field support equipment? AAF has experience in designing and producing rugged portable environmental support equipment, capable of protecting its payload from vibration, shock, temperature and humidity changes. AAF equipment has served well in missile support such as AAF's, Transair, and precisely all GRAF missile project, ground safety and more World War II.

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### Large Booster Test Stand Proposed

Certain model of a large test stand proposed by CalVal Research and Development Corp. (above) shows grid of water confinement just below nozzle. Test stands have been designed in earlier years ranging from 6 to 24 million lb thrust. Launch can be subject to 8-oz air energy and its offshore sites. This stand would be approximately 215 ft high. Also (above) gives indication of size. Cooling water test run in Nov. at Ft. Meigs (below) and 4000-lb. BFG test is evident picture. CalVal claims in the contract. Volume below the nozzle. Cooling water at 3.5 times preflight flow rate reduced some heat from 150 deg. to 124 deg. F below the nozzle and also caused exhaust temperatures to be lowered from 5,000°F to 3,500°F at the same point below the nozzle.



### SKYBOLT



This new USARF weapon now under development will combine the range and mobility of the jet bomber with the speed and the difficult-to-detect capabilities of the ballistic missile. Yet Skybolt's warhead-carrying re-entry vehicle must operate with the same reliability and accuracy of ground-launched re-entry vehicles.

**Environmental conditions**—The re-entry vehicle must withstand heat after hour of vibration and more before about its bomber "launching pod"—the USARF B-52 and the RAF Vulcan bomber. Its heat protection system must endure repeated thermal cycling from ground take-off to time pressure to -65° F at cruising altitudes. It launched it could be exposed to re-entry temperatures of 7,000° F.

**Extended life**—Skybolt's re-entry vehicle must have a useful life of several years, through repeated storage, thermal cycling, and return to storage—all with a minimum amount of maintenance.

The Skybolt missile system is being developed from known and proven engineering principles, resulting in rapid program advancement, at great saving to the American taxpayer. The Missile and Space Vehicle Department of General Electric's Defense Electronics Division is developing Skybolt's re-entry vehicle.

**GENERAL ELECTRIC**

MISSILE AND SPACE VEHICLE DEPARTMENT, PHILADELPHIA, PA.

**SKYBOLT** is being developed to add a new dimension to America's growing missile might. Launched from an airborne B-52, it is being designed to arc through space toward targets more than 1,000 miles away. The re-entry vehicles for this advanced USARF missile are being developed by General Electric's Missile and Space Vehicle Department under contract to Douglas Aircraft Company, prime contractor for Skybolt.

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concrete beam acquisition. Samples of beam return pulverized by the vehicle laser shift are fed into the analyzer through a trigger and feed return into processing probe transmitters made the future riches 4,000G.

■ **More spectrometer**—Evaluation of more spectrometer techniques is being conducted for IPT by Bendix Research Laboratories. Delayed 7th, initial design of a spectrometer for laser interferometry is not yet firm, but Bendix is aware of its wide scale concept so spectrometers, one of which weighs 17 lb occupies 400 cu in. and draws 15 watts. The design of Bendix's more spectrometer would not necessarily follow the same basic. The more spectrometer dimensions, the wavelength of different radiation characteristic of the mass of the periodic table.

■ **New spectrometer**—A new spectrometer radiation, sensitive to identify 17 elements and requiring only 25 watts compared with the 75 kilowatts needed for a laboratory instrument was developed by the TSC-IDS teaming by Dr. Donald C. Miller in a report prepared by him and Charles F. Bendix both with Philip Electronics Laboratories, Mount Vernon, N. Y.

This spectrometer, developed with the support of IPT, will be able to detect the presence of elements whose magnetic carbon potassium copper selenium vanadium titanium manganese chromium iron and nickel is by using laser samples with high-energy electrons, then directing cooled X-ray radiation. Since the X-ray spectra of these elements are known, presence of the element and amount of it can be determined from the width and height of peaks in recorded spectra (positive charts).

The X-ray spectrometer tends to be more sensitive than the spectrometer than the Bendix's spectrometer which can pick up the lighter elements, so called in Enmer.

Overriding problem in designing the spectrometer, Miller said, was in having controls required to identify these elements with only 25 watts of power available to the spectrometer in the spectrum. This involved three or four different design decisions. First of these was the choice of direct electron excitation of the sample rather than the use of fluorescent excitation (X-ray tube) which at least background radiation.

Direct excitation is more efficient however, giving a 1,000 to 1 gain in intensity and still allowing sufficient sensitivity for determining elements present in significant abundance. A second major choice was the selection of a combination of dispersive optics (using a crystal) or an X-ray monochromator to sort out X-rays emanating from the specimen and non-dispersive optics (electronic discrimination of

probe, height obtained from an energy window X-ray detector).

The dispersive technique will handle spectra variations and dispersive will be for testing and non-dispersive Spectrometer detector for a pure point or limited spectra with electronic discrimination through the wavelength resolution is very poor.

The third decision was the selection of an instrument with 15 feed through with a per channel crystal monochromator in each channel. This provides 17 signal channels and 2 background channels. The flexibility of measuring type of spectrometer was sacrificed to compensate the weakness of complexity of

existing equipment. Miller said.

■ **Neutron gamma ray spectrometer**—Neutron gamma ray spectrometer composed of a neutron sensor and a gamma ray detector, operates independently of geometrical orientation and can count gamma rays at a half-hour count, according to a report prepared by the University of the Lowlands, Radiation Laboratory, University of California. The lead by C. D. Schwab, J. J. Wang, James I. H. Ziegler, R. J. Street and K. F. Martin (now with Aeroquip Corp.).

In the same package is a miniature neutron spectrometer which will produce a pulsed beam of 10 MeV neutrons



Both engines were made in the same factory at the same time. Both have the same manifold at base and overhead, yet little is "quicker" than the other.

Direct application of Service Bulletins of overhaul has kept the Airwork overhauled engine up to date. Maximum use of Service Bulletins and "inside of the seat" attitudes has held the other engines behind the "other" even though the same age as the first.

The number of Service Bulletins applied depends upon the standards of the individual overhaul shop. At Airwork, we directly Service Bulletins in "downside" or "upside". We apply all "downside" Bulletins. Occasionally there may be a special advantage in "downside" one, but these cases are rare. Optional Bulletins are applied upon request, as to meet unusual operating problems.

For example, we install flooded rocker boxes, plain type roller type carbon bearings, ball bearing roller shafts, more durable roller shafts, high capacity main oil pump, roller box mounts in place of simple disk type main oil screen, plain type roller bearings and similar improvements when these modifications apply.

Other parts are replaced into newer, more reliable forms. We replace the lead screws with bearing service, disassemble and replace roller shaft components so they won't leak roller shaft water (how this is done) and take advantage of our expedited equipment by testing certain plain roller shafts on some of the main power equipment in our turbojet shop.

How much work is done on your engine—and how well—depends upon the "youngster" flying today. They are our specialty.

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# Flight Propulsion NEWS

A report on progress in research and development in the Flight Propulsion Division of the General Electric Company



The marks of May witnessed new records set by the McDonnell F4H Phantom II (left) and Convair's B-58 bomber (right). Both are powered by G-E Mach 2+ J79 turbojets.

## McDONNELL, CONVAIR JETS SET NEW MARKS

CINCINNATI, Ohio—Two U.S. Mach 2+ aircraft, powered by General Electric J79 turbojets, added to their long array of records by logging three new jet age milestones during the month of May.

Within a three-week period a U.S. Navy McDonnell Phantom II was the fastest turbojet while smashing cross-country speed records in General Electric J79 turbojets, added to their long array of records by logging three new jet age milestones during the month of May.

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## TWA, NEA Increase TBOs

CINCINNATI, Ohio—Trans World Airlines and Northeast Airlines have received FAA approval to increase TBOs between Overhaul to 1000 hours for their GE45-3 turbojet engines.

The General Electric CJ-603-3 had been in service for roughly four months, proving the two airlines' Convair 440 jetliners.

Commented T. J. Harris, G.E.'s manager of Commercial Engine Maintenance and Operations Engineering, "This rate of advance is allowable time between overhauls is extremely rapid from an industry standpoint."

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## V/STOL Diverter Valve Proven Successful in Tests

CINCINNATI, Ohio—A low-cost, light-weight valve that efficiently directs engine exhaust flow in proper V/STOL aircraft has been built and tested successfully by General Electric's Flight Propulsion Laboratory Department here.

Added to a standard powerplant as an exhaust-exhaust diverter, the valve permits exhaust gas to be employed for either forward flight or lifting purposes. The valve is designed so that exhaust gas may flow straight through or be diverted 90 degrees to power direct lift or lift-plus forward.

Tests of full-scale valves have shown forward thrust to be low. Thirty-one hours of engine testing included 13 hours above 95% speed and low forward thrust cycles without failure or performance deterioration.



Further tests at Roskilde have evaluated the diverter valve performance during static testing of the G.E. turbofan system. Full-scale testing of the G.E. turbofan system will be conducted here this year.

## Direct-lift VTOL Engines Under Study



The VTOL direct-lift propulsion system, used in conjunction with primary turbojets, is being considered for research aircraft in the future. Available lift-thrust, lift-thrust, and lift-thrust are currently under study at General Electric.

During takeoff and landing, vertical thrust is provided both by small direct-lift turbojets (16), and primary engines (1) using engine exhaust. Based on altitude, the wings and tail (2) controls lift-thrust. After transition to horizontal flight, the direct-lift turbojets will not power and the primary powerplant will propel the aircraft at supersonic speeds.

## New Engine Test System Is Movable, Economical

CINCINNATI, Ohio—A new engine test system that can provide test cells with exhaust and oxygen of approximately one half to two thirds over previous concrete cells is now being offered by General Electric's Los Angeles Aircraft Service Shop.

Used for engine trouble-shooting and post-overhaul check-out, its performance compares favorably with that of previous concrete type cells. It also can be situated or added to, providing flexibility and economies not feasible with permanent cells.

A prototype cell is in operation at G.E.'s Aircraft Service Shop in London, N. J., where it is being used for test bed and trouble-shooting of Convair 440 CJ-603-3 engines. Its design also permits accommodation of all other turbojet and turbofan engines of any manufacturer.

The system is supplied with an air-conditioned control house containing instrumentation and engine operating controls. Aluminum construction assures durability, and space is ample for operation and attendance. Instruments are readily accessible via a walk-in area behind the control panel.

The engine-out room was developed jointly with the Rockwell Company, a leader in the field of an engine room control. Easily accessible, it resembles permanent concrete cells in shape and dimensions. Room, inlet and exhaust passages are constructed of steel plate.

Complete information about these test cell facilities can be obtained by contacting the General Electric Company, Aircraft Service Shop, General International Airport, Denver, Colo.



G-E powered HO4S helicopter is now providing speedy Bay Area shuttle service.

## Turbocopter Service Inaugurated in San Francisco-Oakland Bay Area

SAN FRANCISCO, Calif.—Sikorsky HO4S turbocopter service was recently inaugurated here by San Francisco and Oakland Helicopter Airways.

Initially, the airline plans service between downtown San Francisco and Oakland airports. San Francisco and Metropolitan Oakland International.

## Sikorsky HO4S Sets Speed Record

WASHINGTON, D.C.—A U.S. Navy Sikorsky HO4S turbocopter recently dropped a new helicopter world speed record of 172.9 mph. Fastest speed was previously 157 mph, a record earned by the Sikorsky HO4S in 1959.

The advanced turbocopter, built by Sikorsky, is powered by two General Electric T58 gas turbine engines, which can over 6000 feet service.

Asports, and Berkeley and Palo Alto. The General Electric T58-powered turbocopter will traverse these routes in flying times ranging from four to 12 minutes.

According to Airline President M. F. Buge, the turbocopter operates more than 10 years of effort by San Francisco and Oakland to introduce passenger helicopter service similar to that enjoyed by Los Angeles, Chicago and New York.

"On Bay Area operations," Buge said, "it is going to be included eventually. Unlike other scheduled helicopter carriers, we are starting in a non-scheduled basis. It can be said that the Bay Area has the potential to support full-time helicopter service, prove correct, the long-haul service of the helicopter could well become part of the route in all major cities in the country."

Commenting on the Sikorsky HO4S turbocopter, Buge said, "This turbine power gives it smooth, steady and rapid. The excellent power-weight ratio of the General Electric T58 engine and the 16-cylinder turbine and compressor of this aircraft make it the most dependable helicopter ever built."

## FOR MORE INFORMATION

General Electric Company, Inc., AERO-32, Schenectady, N. Y. Please send us more information on:

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY & ADDRESS \_\_\_\_\_

GENERAL ELECTRIC



Typical of General Electric's new air-temperature engine test system in this unit is one of G.E.'s London (N. J.) Aircraft Service Shop. The small control house contains equipment needed to check engine test in the runways at left.





## New Offerings

**Thompson Business Woldedge, Inc.**, Cleveland, Ohio, principal services of the company and its subsidiaries is the performance of research, consulting and advisory services and the manufacture and sale of products in the areas of space and electronics, and the manufacture and sale of aircraft components parts and auxiliary equipment, largely for aircraft engines a wide range of engines and other parts for automobiles, trucks and tractors, and manufactures other products. Offering is \$75,000,000 of 25 new debentures due 1976 for public sale, interest rate, public offering price and underwriting terms to be supplied by amendment. Proceeds will be added to the company's general funds; the company plans initially to reduce its research outstanding. V Lane brokerage is solicitor for the offering.

**Power Design, Inc.**, Waltham, N. Y., engaged in the design, manufacture and sale of power supply equipment for the conversion of commercial ac power into precisely controlled voltage and current sources for scientific and reliable operation of complex electronic equipment. Offering is 100,000 shares of common stock for public sale at \$2 per share; offering to

be made as an after issue loan. Proceeds will be used to retire a bank loan (\$150,000); to expand research and development activities (\$100,000); for internal plant expansion for production (\$500,000) and to provide additional office space (\$25,000); to establish a source for property acquisition (\$140,000) to supplement working capital and possibly funds for expanded activities on the West Coast and possibly into Canada and Europe. The company has an option to purchase its plant and adjacent property, now under lease.

**Rival Dynamics, Inc.**, Brooklyn, N. Y., engaged in designing, engineering, manufacturing, producing and selling electronic and mechanical assemblies, electronic and analog hardware components and systems, and special tools and fabrications. Offering is 100,000 shares of common stock for public sale at \$7 per share on an all at once basis. 70,000 shares are to be offered by the company, and 30,000 outstanding shares by Melvin D. Douglas, president. Of the proceeds from the company's sale of additional stock, \$100,000 will be used to pay a bank loan, \$100,000 to expand research and purchase raw materials, \$100,000 to acquire acre and larger facilities for the business, \$50,000 for research and development; the balance for working capital.

**Clifton Precision Products Co., Inc.**, Clifton Heights, Pa., engaged in the design, development, production and sale of a variety of mechanical, electro-mechanical and certain servo-mechanisms for use primarily in aircraft and missiles. Offering is 60,000 outstanding shares of common stock for public sale by the holder thereof John F. Clouse company president offering price and underwriting terms to be supplied by amendment. Clouse owns 251,100 shares (57.9%) of the outstanding stock, sale of the 60,000 shares will reduce his interest to 55.9%.

**Dection Electronics Corp.**, New York, N. Y., engaged in designing, engineering, manufacturing and selling electronic equipment for the U.S. government. Offering is 50,000 shares of common stock for public sale at \$2 per share. 30,000 shares are for sale by the company and 20,000 outstanding shares by the present holders thereof. Of the proceeds from the company's sale, \$80,000 will be allocated to research and development and the balance to general working capital.

**Fourier Arkins, Inc.**, Denver, Colo., engaged in the transportation of passengers, property and mail. It serves 66 cities in 11 states. Offering is 250,000 outstanding shares of common stock for public sale by present holders thereof.



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Here is the most recent of a number of major achievements Janitrol has made in production and testing for the space age. To test cryogenic components and systems we have just completed this versatile facility—one of the few of its kind capable of handling liquid hydrogen.

The test chamber is a 500-gallon Dewar, 6-foot deep, 4-foot in diameter designed to accept components of the same size. The supply Dewar has a capacity of 3000 gallons.

The test Dewar may be used for either static or dynamic

testing under cryogenic temperatures within a pressure range from 1 psia to 75 psia, made possible by incorporating 3000 cfm centrifugal vacuum pumping capacity into the system. This permits testing with a multitude of flow rates and pressure conditions simulating near "space" conditions. Complete instrumentation includes recording all parameters on a remote time base.

Consult your Janitrol representative on your next requirement for cryogenic hardware and systems.

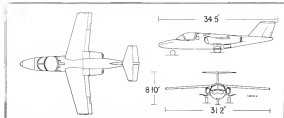


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## BUSINESS FLYING



THREE-VIEW of Saab Aircraft Co.'s test prototype multi-purpose Saab 105 test aircraft scheduled to fly early in 1981.

## Saab Reveals Entry in Twin-Jet Market

By Edith Wallsted

Gothenburg—Sweden's Saab Aircraft Co., with a long history as a designer and producer of military aircraft, plans to break into the multi-purpose, twin-jet light-aircraft market by early 1981.

The Swedish company exhibited a model of its first prototype Saab 105, an all-metal, high-wing, four-engine aircraft jet transport, at the recent Paris International Air Show (IAW June 29, p. 118).

The Saab 105 is a computer-aided system initially designed to meet Swedish air force requirements for up to 15 seats, high-wing, advanced trainer. Saab hopes to make it a successful commercial venture as well. The Swedish air force will receive some of the first production units during 1981.

Capable of carrying 1,500 lb. of maximum externally, the military version also can be used as a light ground attack aircraft. Other basic design studies include versions for liaison, bomber, flying reconnaissance, mapping and surveillance purposes.

The inside loading gear of the Saab 105 consists of a hydraulically operable conveyor which extends forward into the fuselage and to a nose wheel which allows the center fuselage section. It is fitted with single disk brakes and an integral turning device can be installed as an optional extra.

The wing is of stressed skin construction with two main spar span. The narrow space between the spar stations carries integral fuel tanks with a total content of 175 gal. The lower wing surface

has numerous attachment points.

The fuselage is of light-metal stressed skin construction. The cabin as projected and located ahead of the wing in the forward fuselage section. Large, curved acrylic glass windows of low good forward and side vision and

the cockpit is operated by an electric release, but also can be opened manually. The standard military transport version accommodates two passengers side-by-side in the cockpit, but two additional seats or a bench can be installed immediately behind the pilot's

### Saab 105 Specifications

DIMENSIONS	
Wing span	34.2 m
Wing area	175 sq. ft.
Length	34.5 ft.
Height (from ground to top of tail)	11 ft.
Wheel track	9.7 ft.
Wheel base	37.8 ft.
Cabin width at floor level	
Front seat	4.08 ft.
Rear seat	4.2 ft.
WEIGHTS (military version)	
Empty weight (including two pilots seats)	4,400 lb.
Empty weight	4,475 lb.
Takeoff weight	6,569 lb.
PERFORMANCE	
Takeoff distance (50 ft. obstacle)	2,130 ft.
Landing distance (50 ft. obstacle)	1,180 ft.
Sea level rate of climb (at takeoff thrust)	4,780 fpm
Cruise speed	1,510 fpm
Service ceiling (at maximum continuous thrust)	41,330 ft.
Cruise engine	79,000 ft.
Top speed (at takeoff thrust)	580 mph
Maximum endurance (cruise speed)	419 mph
Normal cruise speed	408 mph
Roll speed	95 mph
Range at normal cruise speed	1,450 mi.
Fuel capacity	175 U.S. gal.
POWERPLANT	
Two Turbomeca turbojets capable of 3,310 lb. thrust each	



# PROJECT SAINT

## THE FIRST SATELLITE RENDEZVOUS AND INSPECTION SYSTEM

### ... now underway at RCA Burlington

RCA has recently received the prime contract for the most complex satellite system yet created. The program is being carried out in the Boston area—at RCA's Burlington facility.

RCA will develop the complete final stage vehicle to inspect unidentified satellites.

For this challenging undertaking RCA requires top electronic man—men who can combine vast technical knowledge with creative imagination. Specifically, the need is for men and women engineers, mathematicians, and physicists who can move ahead in any of the following technical fields:

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Radio Corporation of America, Dept. 14-90  
Aerospac Communications  
and Controls Division  
Burlington, Massachusetts

All qualified persons should expect a one week reply or contact reply.

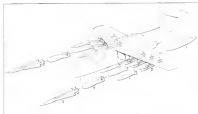


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WITH INTERNAL ARMAMENTS, the Sab 105 can come in tight attack slant

and on pilot's wish to take two or three additional passengers.

For engine crew training purposes, the aircraft can be supplied with optional radar and/or full navigation equipment.

In ambulance or rescue duty, the right-hand seat can be removed to make room for a stretcher. The right-hand attendant line occupies the left-hand seat area. When used for emergency or reconnaissance work, canopy can be installed in the landing gear or in main wing pylon, leaving empty seats in the cabin for a crew of three.

As a light ground attack aircraft with a 1,540 lb. load of armament and sufficient fuel for a sustained combat radius of 100 mi., takeoff and landing runs of the Sab 105 are about 2,000 ft. Maximum radius of action at sea

level with the same load of armament and a reserve supply of fuel is approx- imately 250 mi.

The aircraft, which is controlled by a conventional stick in standard version, can be fitted with a control wheel.

### New Fan Engines

It will be powered by two new Turbomeca turbofan engines each rated at 1,540 lb. thrust. The new engine is based upon the Turbomeca Saturn turbojet power unit. The major change in design, according to Sab, will be the installation of a fuel fan. The new engine currently is being developed by the French company and is scheduled for delivery to Sab by late 1962.

Engines are mounted externally

the wing section, one on either side of the fuselage. Forward support of one of the engines is estimated to be sufficient for takeoff should the other fail. The Sab 105 is capable of up to six hours' continuous flight, its maximum range is given as approximately 1,450 mi. at normal cruise speed. Estimated top speed is 590 mph at takeoff thrust, at 25,000 ft., maximum continuous cruise speed is 450 mph.

The standard version is expected to sell for around \$275,000 including a full instrument panel. Radio equipment, however, is optional and extra. This figure, in addition to low operating costs, is a feature which the company hopes will add to the aircraft's general sales appeal.

## PRIVATE LINES

Dassault Aircraft Industries' refund before 1964 is scheduled to roll off the production line early in May. Next Production of the last Breguet 260 model is being phased out. Two 260s are scheduled for production in August, one in September, eight in October, with a total of 20 to be produced by November. Aircraft modifications to include increased maneuver, improved visibility, better ventilation and heating, new instrument panel arrangement, new design for both engine and intake, and a clearing-up of interior surfaces and control surface fitting.

Working agreement between the manufacturer, Dassault Corp., France, and Calesco Aircraft Corp., Manassas, Va., P.M. Coleman, president, for the assembly and distribution of the Breguet 260 engine lightplane in the U.S. (AW May 20, p. 56) has been forwarded.

Arco Corp.'s Lowing, Div., St. Paul, Minn., has completed the first test run of a new turboprop engine rated at 2,315 hp. Engines designated LTC-43 will drive a split-power gas turbine. Insects are third of eight now in the shop. The first stage reduction gear, while two-thirds are mounted by the second stage reduction gear. Gear is integrated in the front of Lowing's 1954-5 engine. Weight, including gear system, is 15 lb.

Federal Aviation Agency is surveying medical and related emergency facilities of civil airports throughout the U.S. in line with its responsibilities to promote civil aviation and aviation safety. Areas to be reviewed by a four-man survey team will cover available equipment and hospital facilities at the airport as well as medical medical facilities, and other health and welfare facilities for passengers, air crew and support workers.



# 17 reasons why you get highest reliability with G-E Five-Star tubes

In industrial and communication equipment—critical sockets where there can be no compromise with electronic tube performance—you can depend on the proven reliability of G-E Five-Star tubes. Let these 17 features of a typical Five-Star tube tell you why:

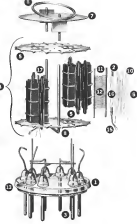
1. Slow slope maintains stable—free state of possible failure—low chance of short-circuiting potential from cold applied.
2. Precision cathode design ensures reliability and long life in low-duty applications where cathode leads to failure.
3. Pass air mounted to prevent glass stress in socket insertion.
4. Start, steady once increase rapidly of tube diameter.
5. Two main supports, with additional air-bridge slots, brace internal parts, provide superior deformation resistance and improve vibration characteristics. 25 at 200 cycles per second (vibration) 25 at 200 cycles per second (vibration).
6. Ability of glass to perform throughout tube life and guide fresh to avoid crown damage.
7. A perforated flash shield supports internal heater characteristics.
8. 1-hr. warmup through top and bottom means finally secures the oven assembly.
9. Padded heater design proved most reliable under shock, vibration and heater cycling conditions. (Heater is temperature controlled to further ensure reliability and lengthen life).
10. Cathode's coating of all heater leads after forming means superior heater-to-cathode insulation.
11. Smooth grid top prevents a "cannon" action on the stem, reducing grid vibration and microphone noise.
12. Grid pins are pre-plated with gold or silver to minimize grid erosion.
13. Lead glass stem help ward off glass shattering.
14. Controlled thermal expansion on leads improves vibration and mechanical shock resistance.
15. Low thermal-expansion coefficient permits removal from base.
16. Outside diameter and density of cathode coating is substantially maintained.
17. Plate area is enhanced for added strength and improved noise fit.

G-E Five-Star tubes are not tubes selected from standard receiving types.

These high reliability is a result of these special design details, special manufacturing processes, special tests, and stabilizing periods which may reach almost 200 hours of full-electricity operation. Only G-E Five-Star tubes from General Electric tube distribution. He has them in stock, General Electric Company, Distribution Sales, Room 218A, Owen Sound, Kentucky.

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## SAFETY CAB Accident Investigation Report:

### Excess Yaw Cited in 707 Peconic Crash

At approximately 1641 ed.t., Aug. 15 1959, an American Airlines Boeing 707 N 7514A crashed and burned in an open field approximately three miles southeast of Peconic River Airport, Cutchogue, Long Island, New York, during a training flight.

All five crew members, which included the captain-instructor, two captain-instructors, flight engineer-instructor, and one flight engineer-instructor, were killed instantly. The Board believes the accident was caused by the failure of the crew to bring yaw and correct the development of excessive yaw which resulted in subsequent loss of control. The sole-skidmaster manner which followed occurred at low low on the tube in present complex manner.

Subsequent to the accident, the Federal Aviation Agency discontinued the flight permit that Boeing 707 aircraft make, actual findings with involved factors of 90% of the power entry, occurred on one side of the aircraft during training flights type errors and preliminary checks. These aircraft may not be available at an appropriate level of safety.

On Feb. 5 1958 Boeing Co issued a service bulletin approved by the FAA for its transport rubber assemblies which will limit power to the wider range of directional movement and give increased control capability at low speed and maximum in great reduction. This modification also replaces the original rubber with an improved resin.

#### Investigation

On Aug. 15 1959 Boeing 707 121, N 7514A, which had been regularly used for training purposes, crashed near Peconic River Airport, Cutchogue, Long Island, New York, was scheduled for two training flights.

Following completion of the first training mission flight, a technical check was accomplished and several minor discrepancies were corrected. In order to bring the first test to a satisfactory conclusion, the test was added. The engine oil and water tanks were removed to the required position.

For training purposes flight 121 was dispatched with Capt. J. J. C. Johnson as captain-instructor, Capt. Fred W. Johnson and William T. Smith as captain-instructor, flight engineer-instructor, and flight engineer-instructor. At Peconic River Airport, flight engineer-instructor. At departure Capt. Johnson assumed the captain's seat. Capt. Johnson occupied the first officer's seat. Capt. Smith was in the second officer's seat. Flight Engineer Freeman occupied the flight engineer's seat, and flight Engineer Anderson was in the third seat. The aircraft took off from Merrill International Airport at 1640 with a gross weight of 70,140 lb. The flight plan was direct to Peconic River Airport.

Training flight 514 accomplished high

altitude approach after climb to point sufficient for landing. The approach maneuver which was planned at Peconic River Airport.

Subsequent to the departure of flight 514, two company pilot-instructors were made with the aircraft. The captain observed an air-to-air collision between the aircraft, approximately 1717 company advised the flight that N 7514A was being considered for an air-to-air collision. The flight was in a steep climb. A communication from the flight stated that the aircraft had probably used a low change point to avoid collision.

Peconic River Airport at Cutchogue, Long Island, is used by American Airlines and other airlines as a training airport. The training personnel are employed by the General Aviation Engineering Corporation.

Peconic River Airport, Long Island, has indicated that training flight 514 was in the Peconic area from 1711 until the second accident. During this time the crew had flight 514 accomplished several maneuvers including following landings, increased landings and shortly a high left approach, executed approach, and landings, and a steep approach approach to landing.

The Peconic River tower controller told the aircraft did not return to landing area following the last descent approach to landing on Runway 23 but continued in the traffic pattern at an estimated altitude of 1,000 to 1,100 ft. The crew reported no left bank, but for Runway 23, was given clearance to land and was informed that the road was clear 1,000 ft to 1,100 ft.

The last communication from the crew was the aircraft's location of landing clearance and was information at which time the aircraft was reported to be in the air.

Several witnesses near the airport area were contacted in the present at Boeing 707 aircraft at the air over the area. The witnesses reported that the aircraft, a considerable number of the witnesses observed N 7514A and they were of the opinion that the aircraft was lower than flight 514. They were not making any more than that. Some witnesses also observed smoke coming from the engine on one side of the aircraft prior to impact.

Two witnesses positioned near the landing pattern flight path observed the aircraft in a controlled descent on its approach to land. N 7514A was observed to turn on the last leg to a southeasterly direction.

The aircraft was observed to be in a steep descent to be at an altitude of from 600 to 1,000 ft. At or approximately the extended position of Runway 23 it made a left bank steeply to approximately 45 degrees. The aircraft was then observed to be in a southeasterly to left turn and to begin a bank to the right at which time, possibly during the right bank, smoke red into the aircraft was observed at which time the nose dropped and a yaw to the

left was observed. N 7514A then continued to roll to the right as a members witnesses then rapidly descended to from 30 deg. to 60 deg. The aircraft crashed from a steep right bank with the wing low, approximately 10 deg. to the left of the course line, which the witnesses stated.

Investigation of the accident aircraft showed the ground in a southeasterly direction in a southeasterly direction, yawed to the left approximately 12 deg. with considerable yaw. The aircraft was approximately 10 deg. to the left of the course line, which the witnesses stated.

A witness located far below the impact area stated that the aircraft was in a steep climb at the time and was a factor in the accident.

One witness a private pilot, was flying a C-47 aircraft and was observing the aircraft and looking from a small field in the area approximately one-half mile from the impact area. The witness testified that he was flying his aircraft on a southeasterly heading at an altitude of approximately 1,000 ft. when he observed N 7514A in the air at an estimated altitude of 600 ft. He observed the 707 enter a shallow turn to the left (bank) and observed the separation between the two aircraft as approximately 800 to 1,000 ft. He testified that he did not recommend about the position of the two aircraft was on a only saw smoke and believed no more witnesses were required.

N 7514A crashed and burned in a small level patch of field approximately three miles southeast of the Peconic River Airport. The wreckage was not confined to approximately the wing area of the aircraft in north and 15 times the length of the aircraft with the two components strung in the direction of travel approximately 300 ft from the point of impact.

The wreckage broke up into small sections at impact, the sections between the fuselage and wing section and sections between the wing section. Nearly all of the fuselage sections showed the air pressure hull big ducts and a considerable cockpit section was observed. The fuselage sections from both ends scattered throughout the wreckage.

The wing main panels broke off and lay in front of the fuselage sections and were partially consumed by fire. The ribbed main wing sections were scattered across the upper rib sections, showing less heat damage than the lower section.

The horizontal tail section remained attached to the tail cone and showed relatively little impact damage and no fire damage. The vertical fin and the stabilizer were also relatively undamaged. The wing sections for the fuselage and secondary impact area were not the tip. Ground impact was along a direction of approximately 280 deg. may

Investigation also related the landing gear was fully extended and that all air



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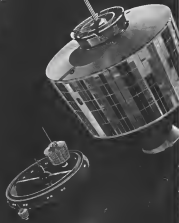
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the obscurity of a light search for and to the right of the Boeing 737's flight path. Subsequent flight tests, revealed that the light search could have been at slowing factor and a possible cause for error. The aircraft sitting on the right side could have indicated that error, when should be taken and in the process of a long control of the aircraft, the student should make general before the aircraft around control of the cockpit. These circumstances pertaining to the presence of a light engine are possible, however, certain points are difficult to analyze.

First, it is believed that a prudent outcome for a student should be the student, as well as of the instructor, training and justifiable in the type maneuvers being conducted and prevent the development of a critically unsafe condition. Secondly, the testimony given by a Boeing test pilot indicated that under emergency could be so complicated successfully even though the aircraft was in an experimental phase, conditions.

### Conclusions

After the consideration, the present absence of evidence suggests the most likely of fact for the loss of control was either the lack of repetition of subsequent control, or an inadequate release of left engine thrust, maximum thrust. The delayed engine thrust, which together with the decision to advance power on the right engine instead of slowing power on the left and engine-powered the turn and induced roll to cause severe and uncontrollable.

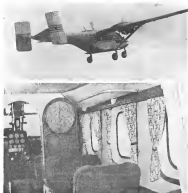
Subsequent to the accident, the FAA documented the requirement that Boeing 737 aircraft make actual landings with simulated failure of 50% of the power with concentration on one side of the aircraft during training flights, type ratings and proficiency checks. These maneuvers may be executed at an appropriate higher altitude.

On Feb. 5, 1980 Boeing Co. issued a service bulletin approved by the FAA for an improved fuel distribution, which adds boost power to the wider range of directional movement and gives increased control capability at low air speeds and maximum gross weight. This modification also replaces the original radio with an improved version.

Although the Civil Air Regulations do not require a flight recorder to be operating during training, test or free-flight operations, it is a standard in some aircraft certification. The flight recorder aboard N 737-44 was operating during this training flight and considerable information concerning the maneuvers and flight path solutions test was just to suggest was obtained through selection of pertinent data on the flight recorder tape.

Even though the records were severely damaged, considerable information was taken and graphed to assist the Board in determining a probable cause for the accident.

On Jan. 12, 1980, the Board notes needed to the manufacturer, Federal Aviation Agency, that flight recorder be installed on all new transport type airplanes and presently operating turbine-powered transport type airplanes. Subsequent to this date and in the wake of the information



## Russian An-14A Has Different Tail Than An-14

Tail assembly of the Russian An-14A Polibot (Little Red Light) transport aircraft has been modified from the original An-14 (AN-14, p. 47) by addition of dihedral to horizontal tail surfaces and increased stabilizer area. Changes were probably made to improve tail effectiveness and give better engine-out performance. Seven passenger An-14s already exhibited at Moscow's Vnukovo Airport can reportedly take off and land from 164-ft. long runways. It is still undergoing testing.

### SUPPLEMENTAL DATA

period, how the flight recorder in this accident the Board has expressed the opinion to the manufacturer, Federal Aviation Agency that recorder should also be installed and operating during the training test and free-flight operations of these aircraft. It is the Board's belief that in the later operations the aircraft was subjected to the same errors except thrust and flight loads experienced in scheduled service.

### Probable Cause

The Board determines the probable cause of the accident was the crew's failure to recognize and correct the development of excessive yaw which caused an unstable rolling flight maneuver at an altitude too low to permit corrective recovery.

By the Civil Aeronautics Board:

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ROBERT T. MERRITT  
Vice Chairman  
GUY GUYARD  
Member  
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Member

The Civil Aeronautics Board has notified of the accident at TWA, Jan. 15, 1979. An investigation is immediately initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958. A public hearing was called by the Board and held in two phases. The operational phase of the investigation was held at the Trump Plaza Hotel, New York, Long Island, New York, on Aug. 27, 1979. The technical phase of the investigation was held at the New York State Office Building, Long Island, New York, Oct. 7, 1979.

### Flight Personnel

Captain Anthony Barry C. Job, age 47, was employed by American Airlines on Nov. 4, 1978. He was qualified to captain on Oct. 17, 1975, and to flight instructor on Nov. 1, 1975. He held a total FAA multi-engine rated certificate with ratings in Cessna 240, DC-8, DC-7, and Boeing 737 aircraft. Capt. Job had a total of 12,000 flying hours as of Jan. 11, 1979. His latest flight check physical examination was taken Apr. 1, 1979. Capt. Job had completed the special Boeing 737 ground training course and had over 216 hours to his

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## Auxiliary Power Unit Installed in 540s

McDonnell Aircraft's Conquest 540 helicopter aircraft will be independent of ground support equipment after installation of an auxiliary turbine in the tail. The new turbine generator and electrical power for engine warming, starting, ground air conditioning or heating, and ground checkout of aircraft electrical system. The power units are produced by McDonnell Mfg. Division of the Garrett Corp., Los Angeles, Calif., which last produced two major units for Conquest 540s (Navy-powered Conquest

540 aircraft 185 lb. of which were in an aircraft. Capt. Job had flown with approximately 50 stations in the 10 transition program.

Capt. William V. Brown age 49 was on board in American Airlines on Sept. 8, 1991. He was promoted to captain on May 1, 1990. He held a valid PMA (pilot's transport pilot certificate with ratings in Conquest 540, DC-8, DC-6, and DC-7) as well. He had a total of 21,000 flying hours as of Feb. 28, 1990. His latest first-class physical examination was taken Feb. 28, 1990. Capt. Brown had completed the special Boeing 707 ground training course and accumulated 975 hr. of pilot time, 54.12 hr. of flight observation time and approximately 27 hr. of flight observation time in Boeing 707 aircraft and had 18 hr. of Boeing 707 simulator time.

Capt. Paul W. McIntosh age 39 was employed by American Airlines on Apr. 22, 1970. He was promoted to senior captain on Oct. 25, 1981, and to captain on May 25, 1986. He held a valid PMA (pilot's transport pilot certificate with ratings in Conquest 540, DC-8, DC-6, and DC-7) aircraft. He had a total of 20,175 flying hours. His latest first-class physical examination taken June 14, 1990, included a review of lower back x-rays. He accomplished a company promotion on Feb. 15, 1989. Capt. McIntosh had completed the special Boeing 707 ground training course and accumulated 910 hr. of pilot time, 28.18 hr. of flight observation time and approximately 25 hr. of flight observation time in Boeing 707 aircraft

and had 10.10 hr. of Boeing 707 simulator time.

Flight Engineer Instructor Arthur Anderson age 46 was employed by American Airlines on Feb. 16, 1940 as an apprentice engineer. He was promoted to flight engineer on February 15, 1991, and to flight engineer instructor on May 11, 1991. He held a valid flight engineer certificate with ratings in DC-8, DC-6, and Boeing 707 aircraft. He had a total of 5,000 flying hours 149.50 of which were in Boeing 707. He had over 104 hr. as a flight engineer in service. He completed the last PMA class of examinations on Jan. 15, 1990. He had completed a special Boeing 707 ground training course consisting of 151.00 hr.

Paul Eugene Edger, Alvin Thompson age 50, was employed by American Airlines on Apr. 11, 1961 as a flight engineer. He held a valid PMA (pilot's transport pilot certificate with ratings in DC-8 and DC-7) aircraft. He had over 18,330 flying hours as of May 29, 1989. His second-class physical examination was completed on May 29, 1989. He had completed the special Boeing 707 ground training course, had performed two periods of Boeing 707 training, and had accumulated a total of 7.10 hr. of Boeing 707 aircraft time. He also had 18.30 hr. of Boeing 707 simulator time. S-7144, a Boeing 707-123, serial number 17444, was manufactured Jan. 5, 1959. It had approximately 736 hr. of flight time. This aircraft was equipped with four Pratt & Whitney engines, model JT8C-9 engines



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